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& EVALUATION ARMY..(U) DEPUTY CHIEF OF STAFF FOR
(UNCLASSIFIED) RESEARCH DEVELOPMENT AND ACQUISITIO.. FEB 83
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DESCRIPTIVE SUMMARIES OF THE RESEARCH DEVELOPMENT TEST
 & EVALUATION ARMY..(U) DEPUTY CHIEF OF STAFF FOR
 RESEARCH DEVELOPMENT AND ACQUISITIO.. FEB 83
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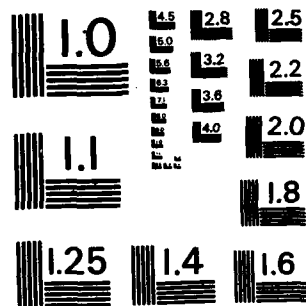
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VOLUME I
Supporting Data FY 1984
Budget Estimate

Submitted to CONGRESS — February 1983

Descriptive Summaries Of The



RESEARCH DEVELOPMENT TEST & EVALUATION
Army Appropriation FY 1984

"READINESS THROUGH MODERNIZATION"

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DEPARTMENT OF THE ARMY DEPUTY CHIEF OF STAFF
FOR RESEARCH DEVELOPMENT AND ACQUISITION
RDTE PROGRAMS AND BUDGET DIVISION

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		

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VOLUME I

DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS OF THE RESEARCH, DEVELOPMENT, TEST AND EVALUATION, ARMY PROGRAM FY 1984 (U) FEBRUARY 1983

This page contains no classified information.

Department of the Army
Deputy Chief of Staff for Research, Development, and Acquisition

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**PROGRAM ELEMENT DESCRIPTIVE SUMMARIES
INTRODUCTION AND EXPLANATION OF CONTENTS**

1. **General.** This section has been prepared for the purpose of providing information concerning the US Army Research, Development, Test and Evaluation Program. The Descriptive Summaries provide narrative information on all RDTE program elements and projects. A Test and Evaluation Section is provided for all major weapon systems (identified by asterisks in the Table of Contents). This information supplements the testimony given by US Army witnesses.

2. **Comparison of FY 1982 and 1983 Data.** A direct comparison of FY 1982 and 1983 data in the Program Element Descriptive Summaries dated February 1982 will reveal some differences. Specific explanations are set forth in the appropriate descriptive summaries, however most of the differences are attributable to the following factors:

- a. FY 1983 reductions as a result of Congressional action on the appropriation.
- b. FY 1982 funding changes subsequent to October 1, 1981, including RDTE Reprogramming Actions.
- c. Restructure of FY 1982 and FY 1983 data to bring it into alignment with the program structure for FY 1984.

3. **Relationship of FY 1984 Budget Structure to the FY 1983 Budget Approved by Congress.** This paragraph provides a list of program elements which were not contained in the FY 1983 RDTE budget approved by Congress.

Program Element		Remarks
Budget Activity 1. Technology Base		
62728A	Exploratory Application of High Technology	New program to develop technologies to improve capabilities of the light forces in the 1980s and beyond.
Budget Activity 2. Advanced Technology Development		
63220A	Advanced Rotorcraft Technology Integration (ARTI)	New program to demonstrate maturing rotorcraft technology prior to engineering development.
63314A	High Energy Laser Components	New program to develop laser weapon technology.

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Program Element (Continued)

Remarks

63637A	Advanced Propellant/Launch System Munitions	New program to develop advanced liquid propellant technology demonstrators.
63756A	Advanced Software Technology	New program to develop embedded computer software.
63758A	Artificial Intelligence/Robotics Demonstration	New program to exploit advantages offered by Artificial Intelligence and Robotics technologies.

Budget Activity 3. Strategic Programs

33152A	WWMCCS Information System	New joint program for WWMCCS ADP systems redesign and replacement.
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Budget Activity 4. Tactical Programs

23741A	Product Improved Vulcan Air Defense System	Restart of product improvement program last funded in FY 1981.
23744A	Aircraft Modifications	New program to provide for preplanned product improvement of existing helicopters.
63316A	Advanced Rocket Control System	New program, content is SECRET "Limited Distribution — Special Access Required."
63741A	Meteorological Equipment Development	New program for Advanced Development of global positioning system and remote sensor for tactical weapon systems.
63767A	Combat Service Support Control System	New program to develop capacity to process and analyze data in support of administrative and logistics support functions and to share this data with other control systems.
64604A	Mobility	New program to develop a replacement medium truck.
64722A	Education and Training Systems	New program to develop demonstrations of prototype training methods and devices.

4. Classification. Classified information is identified by use of brackets []. The abbreviation OADR used in the classification block throughout this document means Originating Agency Determination Required.

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5. Economies, Efficiencies and Management Improvements.

a. Value engineering projects resulted in avoidance savings of \$12.8 million which demonstrate how much higher the Army's budget plan would have been without this economies, efficiencies and management improvement action.

b. Fast payback capital tools and equipment purchased under the productivity capital investment program resulted in avoidance savings of \$12.9 million which demonstrate how much higher the Army's budget plan would have been without this economies, efficiencies and management improvement action.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #61101A

Title: In-House Laboratory Independent Research (ILIR)

DOD Mission Area: #510 — Defense Research

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	21529	21802	22251	25966	Continuing	Not Applicable
A91A	In-House Laboratory — Materiel Development & Readiness Command	16140	16066	16154	18872	Continuing	Not Applicable
A91B	In-House Laboratory — Army Research Institute for the Behavioral and Social Sciences	453	407	466	541	Continuing	Not Applicable
A91C	In-House Laboratory — Medical Research & Development Command	3650	3635	3763	4396	Continuing	Not Applicable
A91D	In-House Laboratory — Corps of Engineers	1286	1794	1868	2177	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides Army RDTE activity directors the opportunity to promote highly promising and innovative research without having to acquire prior or formal approval and subsequent funding. It is one of several measures used to foster creativity, strengthen scientific and engineering competence, aid scientific and technical personnel recruitment and retention, and facilitate communication and interaction within the scientific community through original work relevant to assigned military missions. The program provides the resources whereby high-risk ideas with high potential payoff responding to new technical challenges can be pursued. It serves as a wellspring for innovative and imaginative ideas, of which the more promising seedlings progress into development programs as was the case for electro-optics used in the viewer of night sights and crew-served weapons. Funds are allocated to directors of participating laboratories by the Assistant Secretary of the Army (Research, Development, and Acquisition) and are not subject to reallocation by intervening echelons. This allocation is based on a review of the use of funds and of the accomplishments during the preceding fiscal year.

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Program Element: #61101A

Title: In-House Laboratory Independent Research (ILIR)

DOD Mission Area: #510 — Defense Research

Budget Activity: #1 — Technology Base

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	21529	21902	22251	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	21506	21902	24611	Continuing	Not Applicable

The increase of \$23,000 in FY 1982 funding level is a result of reprogramming to afford the Army Test and Evaluation Command an opportunity to explore unique test instrumentation approaches. The decrease in FY 1984 is due to a reduced growth in the overall basic research program.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The Navy and Air Force have similar programs. Coordination is accomplished and duplication avoided through scientific symposia, literature reviews, exchange of research and technology resumes, Department of Defense topical reviews, and through reports transmitted by the Defense Technical Information Center. There is no duplication of these programs within the Army or the Department of Defense.

F. (U) WORK PERFORMED BY: In-house Laboratory Independent Research (ILIR) is performed in 37 Army RDTE activities (US Army Materiel Development and Readiness Command—24; US Army Medical Research and Development Command—8; Corps of Engineers—4; and Deputy Chief of Staff for Personnel—1). In FY 1982 the allocations for these activities range from \$35,000 to \$2,000,000 while in FY 1983 the allocations are \$50,000-\$2,360,000.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) **General:** ILIR projects are annually reviewed for innovativeness of the research efforts, relevance to the Laboratory mission, and importance of accomplishments during the year of review. At the end of FY 1982, a review panel consisting of select members of the Board of Army Science and Technology of the National Research Council evaluated over 380 projects spanning a broad scientific range from medicine, through most branches of science and engineering to testing and personnel research and made a recommendation to the Assistant Secretary of the Army (Research, Development and Acquisition (ASA(RDA))) about the relative merits of each Laboratory's efforts. Based on the recommendations, the ASA(RDA) allocated new funding for the subsequent fiscal year (FY 1983). Directors of individual activity laboratories then assign funds to both new and continuing promising work units (tasks). The freedom from a rigidly structured program and the resulting autonomy at the activity level permits the

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directors to effectively utilize their ILIR funds. This highly successful program will continue with the current objective of addressing high-technology leverage areas in FY 1984.

2. (U) A91B — In-House Laboratory—Army Research Institute for the Behavioral and Social Sciences: This project seeks to increase the capability and experience of the Army's behavioral and social science investigations. In FY 1982, eight individual tasks were supported with significant findings in the configuration of processed data and battlefield information to enhance the utility of combat visual computer displays.

3. (U) A91C — In-House Laboratory—Medical Research and Development Command: This project exploits the unique concepts and opportunities afforded by promising areas of science that will affect Army preparedness in the medical arena. In FY 1982, 65 individual tasks were supported with significant progress in high-hazard viral investigations, containment of lethal bacteria organisms, and the physiology of acute combat injuries.

4. (U) A91D — In-House Laboratory—Corps of Engineers: Investigations in this project responded to the adaptation of emerging scientific findings in support of military construction, mobility, operations, and maintenance. In FY 1982, 45 individual tasks addressed the assessment of battlefield surroundings, of conservation of fuel, energy, and water resources with important findings in water-ice-soil cold weather feature characterizations.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: A91A — In-House Laboratory—Material Development and Readiness Command

a. (U) Project Description: The Army materiel development community is the proponent for this project. Guidelines and review procedures are the same as for the three projects described in paragraph G. During FY 1982 the US Army Materiel Development and Readiness Command conducted 263 tasks under this project in the scientific areas of biology, chemistry, electronics, geosciences, materials, mathematics, and physics.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: The evaluation conducted by the previously described review process identified 36 work unit areas of significant accomplishment: materials and mechanics, mobility equipment, and missile range instrumentation. Selected accomplishments from among these areas are: (1) surface modification of Kevlar fibers; (2) ceramic-lined gun barrels; (3) hysteretic heating of composite/elastomer materials for tank tracks and road wheels; (4) autonomous operation of exterior physical security equipment; (5) low-temperature oxidation for use in analyzing

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fuel quality; (6) camouflage pattern production and radar absorption techniques; and (7) test instrumentation enhancements of automated reading of videotape, detection of no-contrast targets, and optical testing analysis.

(2) (U) FY 1983 Program: The research program will be based upon the end-of-fiscal-year review ratings which best match the research interests and capabilities of the in-house staff. The program is sponsored by the Assistant Secretary of the Army for Research, Development and Acquisition.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: The planned program will be based upon successful utilization of prior year resources in accordance with previously described objectives.

(4) (U) Program to Completion: This is a continuing program whose objective is to afford maximum flexibility at the laboratory director's level for improving the quality of the Army laboratory by inspiring innovative and bright ideas, and for attracting and retaining top young scientists and engineers.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: 61102A

Title: Defense Research Sciences

DOD Mission Area: #510 — Defense Research

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A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	157668	180500	199158	214134	Continuing	Not Applicable
AF22	Research in Vehicular Mobility	820	1440	1474	1448	Continuing	Not Applicable
AH40	Signals Warfare Research	- 0 -	195	458	741	Continuing	Not Applicable
AH42	Research in Materials and Mechanics	2650	2955	2799	2830	Continuing	Not Applicable
AH43	Research in Ballistics	6530	5755	6164	6985	Continuing	Not Applicable
AH44	Research in Electronics, Sensors, and Signal Processing	2580	2189	2058	2281	Continuing	Not Applicable
AH45	Air Mobility Research	6444	7640	7602	8740	Continuing	Not Applicable
AH46	Research in Combat Surveillance and Target Acquisition	70	70	275	289	Continuing	Not Applicable
AH47	Electronic Devices Research	2384	2650	3806	4011	Continuing	Not Applicable
AH48	Communication Research	1475	2450	3938	5328	Continuing	Not Applicable
AH49	Research in Missile and High-Energy Lasers	3309	4285	4619	4783	Continuing	Not Applicable
AH51	Combat Support Research	1142	1340	1577	1558	Continuing	Not Applicable
AH52	Support of Equipment for Individual Soldier	2366	2125	2562	2633	Continuing	Not Applicable
BH57	Research in Scientific Problems with Military Applications	57519	65905	73379	76448	Continuing	Not Applicable
AH60	Research in Large Caliber Armaments	5527	5890	5574	6376	Continuing	Not Applicable
AH61	Research in Fire Control and Small Caliber Armament	1334	2185	2118	2929	Continuing	Not Applicable

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Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
AH63	Research in Electronic Warfare	880	440	538	746	Continuing	Not Applicable
AH68	Processes in Pollution Abatement	363	400	373	390	Continuing	Not Applicable
BS04	Identification and Health Effects of Military Pollutants	481	493	655	654	Continuing	Not Applicable
BS10	Research on Military Diseases, Injury and Health Hazards	36290	42172	27980	31962	Continuing	Not Applicable
BS11	*Chemical Warfare Effects and Antidotes	- 0 -	- 0 -	13156	11471	Continuing	Not Applicable
BS12	**Science Base/Medical Defense Against Biological Warfare	- 0 -	- 0 -	6762	7107	Continuing	Not Applicable
AT22	Research in Soil and Rock Mechanics	674	895	1159	1253	Continuing	Not Applicable
AT23	Basic Research in Military Construction	691	740	746	794	Continuing	Not Applicable
AT24	Research in Snow, Ice, and Frozen Ground	1826	2235	2810	2972	Continuing	Not Applicable
A31B	Night Vision and Electro-Optics Research	6706	8511	9472	10187	Continuing	Not Applicable
B52C	Research in Geodetic, Geographic, and Mapping Sciences	1714	2370	2438	2548	Continuing	Not Applicable
B53A	Research in Atmospheric Sciences	3430	4900	4526	4806	Continuing	Not Applicable
A71A	Research in Chemical/Biological Warfare Defense	6399	5075	4850	5660	Continuing	Not Applicable
B74A	Research in Human Engineering	1738	2550	2500	2843	Continuing	Not Applicable
B74F	Personnel, Performance and Training	2326	2645	2790	3161	Continuing	Not Applicable

*Project was previously included in Project Number BS10. It is now a separate project and addressed separately in subparagraph H3 within this Congressional Descriptive Summary.

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**This project was previously included in Project Number BS10. It is now a separate project and addressed separately in subparagraph G18 within this Congressional Descriptive Summary.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:

1. (U) Research performed under this program in the physical, biological-medical, engineering, environmental, and behavioral-social sciences initiates new applications of science and technology leading to improved Army capabilities and providing solutions to identified Army problems. Each project is associated with a particular Army mission. This research program responds to highest priority mission area deficiencies and capability requirements as formulated in the Army Air-Land Battle 2000 operational concept. This program element is the foundation for investment in future material developments and combat support needs. The program provides guidance and leadership for the civilian sector to develop needed technologies. Historically, developments have evolved from the laboratory to the field because of the catalyst provided by Army identified and sponsored military research and development. A decade of technology base selected contributions, spearheaded by 6.1 accomplishments include new capabilities now found in the fire control of the Apache Helicopter, the driver's viewer in the Abrams Tank, the algorithms of Patriot that sort decoy and chaff from target, the electronic circuits of artillery and mortar fuzes, and the camouflage dye in the fabric of our soldiers' battle dress uniform to nullify their infrared signatures. The Army Defense Research Sciences (6.1) Program allows the Army in-house research community and its network of outside contract researchers from among leading academic and industrial centers of excellence to address specific Army needs predicated on the maturing of science and provides the mechanism to stimulate interest in the at-large scientific community towards Army problems. Air-Land Battle 2000 provides the guidance for the Army technology thrust areas: (1) very intelligent surveillance and target acquisition; (2) distributed command, control, communications, and intelligence; (3) self-contained munitions; (4) soldier-machine interface; and (5) biotechnology. These five thrust areas underlie our investment strategy for the Army technology base to apply science to equip our forces in the decade ahead. Other areas of high technological interest, including armor-antiarmor, advanced composite materials, military medicine and human factors, vertical lift research and development, adverse weather, guided missiles and projectiles, and high-energy lasers, continue to receive attention. The program does not provide knowledge for knowledge sake. At all levels of management, from Army Headquarters through the developing activities and down to the performing technologists, the Army 6.1 program has received intense management redirection. Such action was taken for several reasons including: (1) new deficiencies identified by mission area analysis; (2) new Army long-range operational concepts; (3) new technological opportunities; (4) Congressional guidance; and (5) diminishing state of science and engineering at our national institutions of higher learning. Thus the Army has embarked on a course of action to structure the 6.1 program to meet immediate opportunities while maintaining longer term efforts needing advanced state-of-the-art solutions.

2. (U) Reductions in the proposed program will be distributed in accordance with a hierarchy of priorities in order as follows: First or highest priority are studies of the action of drugs upon various parts and elements of the nervous system as needed to respond to potentially harmful CW nerve agents, followed by research in new materials for armor, vaccine and drug research against intestinal diseases of military importance, research in gun accuracy and penetrator performance, visual and auditory display concepts, research in helicopter rotor performance, high- and low-energy

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lasers, structural materials, human factors engineering, countermine concepts, new high explosives, advanced material for signal processing and other microelectronics and Corps of Engineers programs on seismic acoustic classification and sound wave propagation.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	157669	180600	199158	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	156610	199921	218098	Continuing	Not Applicable

The increase in FY 1982, \$1,059,000, is a result of reprogramming to increase research in the identification, protection, and decontamination against Chemical/Biological Warfare agents and toxins. The funding decrease in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act and the reprogramming of funds for the High Technology Light Division. The decrease in FY 1984 is a result of reprogramming to higher priority Army requirements.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The Navy, Air Force, and other Department of Defense agencies; National Aeronautics and Space Administration; National Academy of Sciences/National Academy of Engineering/National Research Council; National Science Foundation; Department of the Interior; Department of Energy; National Bureau of Standards; other Government agencies; government agencies of allied nations; and the industrial and academic community sponsor related research in areas of this program. Coordination to eliminate duplication is accomplished by tri-Service topical reviews; exchange of progress reports and technical reports; inter-Service/agency liaison; and formal national and international meetings and symposia. Informal coordination occurs through: visits to governmental, industrial, and academic laboratories and installations; review of the scientific literature; and publications of current research. The Army's Defense Research Sciences Program is included in the Tri-Service Technology Coordinating Papers.

F. (U) WORK PERFORMED BY: The research supported under this program is performed by 35 in-house Army laboratories and activities and by academic institutions, not-for-profit organizations, and industrial laboratories through contracts.

1. (U) The laboratories/activities responsible for conducting elements of this program are as follows:

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- a. (U) US Army Materiel Development and Readiness Command:
 - AF22 — Tank-Automotive Command, Warren, MI
 - AH40 — Signals Warfare Laboratory, Warrenton, VA
 - AH42 — Materials and Mechanics Research Center, Watertown, MA
 - AH43 — Ballistic Research Laboratory, Aberdeen Proving Ground, MD
 - AH44 — Harry Diamond Laboratories, Adelphi, MD
 - AH45 — Aviation Research and Development Command, St. Louis, MO
 - AH46 — Combat Surveillance and Target Acquisition Laboratory, Fort Monmouth, NJ
 - AH47 — Electronics Technology and Devices Laboratory, Fort Monmouth, NJ
 - AH48 — Communications and Electronics Command, Fort Monmouth, NJ
 - AH49 — Missile Command, Redstone Arsenal, AL
 - AH51 — Mobility Equipment Research and Development Command, Fort Belvoir, VA
 - AH52 — Natick Research and Development Command, Natick, MA
 - AH60 — Large Caliber Weapon Systems Laboratory, Dover, NJ
 - AH61 — Fire Control and Small Caliber Weapon Systems Laboratory, Dover, NJ
 - AH63 — Electronic Warfare Laboratory, Fort Monmouth, NJ
 - AH68 — Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD
 - BH57 — Army Research Office, Research Triangle Park, NC
 - A31B — Night Vision and Electro-Optics Laboratory, Fort Belvoir, VA
 - B53A — Atmospheric Sciences Laboratory, White Sands Missile Range, NM
 - A71A — Chemical Systems Laboratory, Aberdeen Proving Ground, MD
 - B74A — Human Engineering Laboratory, Aberdeen Proving Ground, MD
- b. (U) US Army Corps of Engineers:
 - AT22 — Waterways Experiment Station, Vicksburg, MS
 - AT23 — Construction Engineering Research Laboratory, Urbana, IL
 - AT24 — Cold Regions Research and Engineering Laboratory, Hanover, NH
 - B52C — Engineer Topographic Laboratories, Fort Belvoir, VA
- c. (U) US Army Medical Research and Development Command:
 - BS10/11 — Walter Reed Army Institute of Research, Washington, DC
 - BS10/11 — Letterman Army Institute of Research, Presidio of San Francisco, CA

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BS04/12 — Medical Research Institute of Infectious Diseases, Fort Detrick, MD
BS04/10 — Medical Bioengineering Research and Development Laboratory, Fort Detrick, MD
BS10 — Institute of Surgical Research, Fort Sam Houston, TX
BS10 — Institute of Dental Research, Washington, DC
BS10 — Aeromedical Research Laboratory, Fort Rucker, AL
BS10 — Research Institute of Environmental Medicine, Natick, MA
BS11 — US Army Institute for Chemical Defense, Aberdeen Proving Ground, MD

d. (U) Office of The Deputy Chief of Staff for Personnel, HQDA:

B74F — US Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA

2. (U) The top four schools supported under this program for FY 1982 were Massachusetts Institute of Technology, University of Wisconsin, Stanford University, and Georgia Institute of Technology (each in excess of \$2 million).

G. (U) **PROJECTS LESS THAN \$10 MILLION IN FY 1984:** The 6.1 program objective consists of numerous work units each seeking to decrease the vulnerability of the soldier to adverse organic battlefield hazards while improving the military weapon components and devices into an integrated, highly mobile, and lethal man-machine system configuration. The project summaries that follow and the ones in the following paragraph are dedicated to achieving this objective.

1. (U) **AF22 — Research in Vehicular Mobility:** The Tank-Automotive Command is the only DOD activity dedicated to the improvement of combat/tactical vehicle performance, automotive engineering, and related battlefield effectiveness. The understanding and application of central controllers, turbomachinery, fuel injection systems, and high-temperature (ceramic) combustion surfaces are needed to produce the future propulsion and fuel-efficient diesel and gas-propelled vehicles. In FY 1982, outstanding accomplishments included: (1) a fundamental traction versus slip theory was successfully modeled to enhance future computer design simulations; (2) a new methodology for conducting dynamic analysis of vehicle mechanics was substantiated; and (3) a three-dimensional finite element analysis model of track pads was developed and validated. Primary FY 1983 efforts seek to: (1) expand the traction versus slip model to a variety of soil environments; (2) establish a generalized relationship between rigid body and control system servo-actuators; and (3) develop a theoretical control of alternate fuels needed for burst power diesel applications. FY 1984 efforts will concentrate on vehicle engine and transmission problem areas to include: (1) adiabatic engine materials and operating performance characterization; (2) alternate fuels and injection techniques to extend fuel utilization; and (3) analytical studies in power train coupling, advanced compression ignition modeling, and advanced engine concept analysis.

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2. (U) **AH40 — Signals Warfare Research:** The Signals Warfare Laboratory is entering its second year of research in electronic signal intelligence source acquisition, identification, and analysis. The program seeks to characterize our vulnerability to detection as well as our capability to enhance antenna design and signal propagation demodulation, analysis, and fusion for subsequent interdiction. This program was a new start in FY 1983. Primarily FY 1983 efforts seek to (1) initiate an analysis of time delay estimation and interference suppression correlation and algorithms and (2) adapt digital processes for automated acquisition, analysis, and demodulation of signals in a noisy tactical environment. FY 1984 efforts will concentrate on multisensor target location for the attenuated battlefield and signal cluttered environment, increase antenna propagation performance through improved resistance to enemy targeting and reducing multipath and other distortions.

3. (U) **AH42 — Research in Materials and Mechanics:** The Materials and Mechanics Research Center uses microstructure and neutron analysis and spectroscopy and chemical analysis in conjunction with shock-impact and failure degradation modeling to improve the likely utilization of promising metallic, ceramic, polymeric, and composite materials. Selected FY 1982 accomplishment included: (1) identification of shear bending as the dominant failure mode associated with erosion subsequent to deep armor penetration, (2) characterization of ion-implanted surfaces to evaluate organic materials proposed as candidate decontaminations for equipment that has been exposed to chemical-biological agents; and (3) electrodeposition of molybdenum and tantalum onto steel for improved gun tube wear life. Primary FY 1983 efforts seek to: (1) enhance polymeric characterization techniques for thermoplastics, (2) screen emerging materials for ballistic compression, and (3) study material fragmentation under shock-loading and elastic-plastic fracture. FY 1984 efforts will extend neutron radiography to realtime imaging for failure analysis, develop quantitative microstructure characterization of materials, and concentrate on organic and metal matrix composites for use as structural materials and materials for chemical and biological warfare protection.

4. (U) **AH43 — Research in Ballistics:** The Ballistic Research Laboratory conducts scientific investigation in propulsion, launch, flight, and warhead dynamics, and ballistic protection using mathematical analysis, statistics, and decision theory critical to the understanding of behavior small arms ammunition to large missile and warhead weapon functioning. In FY 1982 substantial progress was made in the following: (1) formulating multidimensional, multiphase, interior ballistic simulation; (2) detection of propellant combustions; and (3) development of a scaling law to define pressure versus time history for bore muzzle conditions. Primary FY 1983 efforts seek to refine algorithms for tactical fire control systems; to examine theoretical approaches to nonconical collapse processes in shaped charge jet formation; and to further describe the properties of Kevlar fabric and radar-absorbing coating effectiveness for subsequent simulation analysis. FY 1984 efforts will concentrate on the characterization of ignition and combustion properties of azido-nitro compounds and other reducing agents on nitramine combustion and on blast reflections from weapon surfaces, crew compartments, and blast shields to compute muzzle blast adjacent to artillery weapons for all firing zones.

5. (U) **AH44 — Research in Electronics, Sensors, Signal Processing:** The Harry Diamond Laboratories research activities were recently organized into five technical areas: (1) near-millimeter wave sources/components/materials; (2) radiation effects in microelectronics; (3) fluidic sensor/signal processing; (4) advanced signal/information processing; and (5) high-power microwave sources/devices. Significant FY 1982 accomplishments

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include: (1) production of first US near-millimeter wave oscillation; (2) formulated theoretical/computer-aided-design model of near-millimeter wave conformal array antenna; (3) produced an analytical model and experimental measurement of reflex triode; and (4) discovered a new principle for generating a continuously sliding Fast Fourier Transform (FFT) with analog hardware over wide bandwidths and large dynamic range. Primary FY 1983 efforts seek to evaluate orotron as a source for moderate-power radar applications, identification of radiation effects in short channel metal-oxide-semiconductor devices due to hole trapping, interface state effects, and electron injection; and models for suppression/compression of internal flow fluctuations and noise phenomena in fluidic devices. FY 1984 efforts will focus upon the hardening of very high speed integrated circuits (VHSIC) to intense nuclear weapons effects and intense electromagnetic radiation, the expansion of theoretical/experimental analysis and optimization of currently available high-power microwave sources and devices, and the characterization of information/signal fusion techniques.

6. (U) AH45 — Air Mobility Research: The Aviation Research and Development Command supports research to expand the technologies to produce improvements in operational effectiveness, safety, survivability and reduced life-cycle cost of Army aircraft. Research is oriented toward advanced rotor and fixed-wing aerodynamics, structures, propulsion, mathematical models, and avionics and is coordinated with the National Aeronautics and Space Administration (NASA), Department of Transportation, and Department of Energy as well as the Departments of the Navy and Air Force to eliminate undesirable duplication. Significant FY 1982 accomplishments include: (1) tests of cylindrically contoured end walls for improved turbine efficiency; (2) the refinement of a composite materials design applicable to aircraft primary structures to reduce weight and increase cost savings; and (3) scaled-model measurements of rotor wake to provide a basis for developing advanced analytical techniques to be used in subsequent stability and radar cross-section investigations. Primary FY 1983 efforts seek to: (1) verify rotor wake theory and assess the effect of design variables in reducing noise from rotor wake; (2) utilize NASA facilities to evaluate advanced combustor line cooling schemes; (3) examine thermoforming resins to reduce composite component manufacturing costs; and (4) reduce the computational complexity associated with analyzing malfunctioning systems. FY 1984 efforts will focus on blade-vortex interaction noise prediction, radial mixed flow turbine investigation; use of optical fibers to function as airborne performance sensors for temperature, pressure, magnetic field; and the characterization of full-color cockpit displays in high/low ambient light to enhance navigation.

7. (U) AH46 — Research in Combat Surveillance and Target Acquisition: The Combat Surveillance and Target Acquisition Laboratory has recently increased its research investigation in remote sensing, identification of friend or foe, and pattern recognition of target signatures. In FY 1982 significant progress was made in the collection and analysis of radar-signature data for use in signal processing algorithms. FY 1983 efforts seek to expand the vibration signature data base used with the identification algorithms and to initiate an examination of the feasibility of inverse synthetic aperture radar (ISAR) to provide two-dimensional imaging. FY 1984 efforts will apply ISAR techniques to detection, classification, and identification of stationary targets.

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8. (U) **AH47 — Electronic Devices Research:** The Electronics Technology and Devices Laboratory research program places emphasis upon material fabrication techniques utilizing sophisticated state-of-the-art lithography techniques to generate new and unique microwave and millimeter wave devices, as well as upon ultra-submicron research for future integrated circuits. Such emphasis provides the Army a center of scientific capabilities for the future generation of smart tactical electronics and power source components. In FY 1982, three outstanding accomplishments were: (1) the testing of final resists (printing masks) for high-speed, ultrafine resolution of E-Beam lithography that will make the submicron lithography possible; (2) the identification of an improved regenerative cathode for lithium-thionyl chloride batteries with potential for two- to three-fold improvement over present energy and power densities at low temperature; and (3) generated first computerized model for essential submicron design parameters. Primary FY 1983 efforts seek to: (1) examine lithographic resist for submicron/integrated circuit sealed interface and device applications; (2) fabricate high efficiency super-lattice structures for millimeter wave (MMW) devices; (3) evaluate the performance of millimeterwave (MMW) ferrite phase shifters; and (4) identify plate material for lithium rechargeable cells. FY 1984 efforts will emphasize electronic microwave and MMW materials research to include high-density and high processor speed devices, ultra-submicron electronic chips and new chip compositions.

9. (U) **AH48 — Communications Research:** The Communication-Electronics Command is responsible for tactical automation, digital communications, information distribution/signal processing, formulation of command, control, and communication intelligence (C³I) system theory, antennas for UHF and lower frequencies, electromagnetic compatibility (EMC) near field measurement, ionospheric propagation, and propagation of millimeter and microwaves. Investigations typically must account for communication in built up areas, utility of fiber optics, adverse environmental situations such as EMC and adaptability of millimeter waves for communications. Significant FY 1982 accomplishments include: (1) the evolution of a routing algorithm for finding the shortest path between two network nodes and the corresponding response to ensure proper acknowledgement protocols; (2) the refinement of dielectric antenna theory for omnidirectional as well as highly directional capability; and (3) the specification of application software and a prototype editor for the "ADA" language. Primary FY 1983 efforts seek to (1) address low bit-rate voice and its effects on information network management and on techniques for integrating data and voice on a packet switched network; (2) explore potential of multiple doped silica fibers for increased nuclear radiation resistance; (3) identify criteria for verification of physical/operational C3 system survivability; and (4) study the platform effects of low-profile antennas as well as foliage effects upon antenna polarization. FY 1984 efforts will (1) examine correlations among propagation data from different geographic areas, (2) seek to extend analytical modeling of internetwork environments, (3) complete modeling of band antenna coupling (adjacent antennas), and (4) investigate dispersive communication techniques and define most effective technique to combat antiradiation seeking missiles.

10. (U) **AH49 — Research in Missiles and High-Energy Lasers:** The Missile Command investigates optoelectronic techniques and devices, quantum optics, submillimeter waves, rate processes in high-energy lasers, and holographic doppler imaging for missile applications. Significant FY 1983 accomplishments include: (1) the construction of a unique miniaturized coherent matched filter optical correlator to perform autonomous missile guidance; (2) the discovery and demonstration of a technique for defeating camouflage against a natural vegetation background; (3) the demonstration of three midrange infrared laser lines in molecular hydrogen and in molecular deuterium; and (4) the extension of a photonic correlator memory

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sufficient to permit simultaneous correlation of one input scene with 200 different target scenes. FY 1983 efforts seek to: (1) upgrade instrumentation in the submillimeter wave propagation range and acquire 250-gigahertz (GHz) radar data over a tactical range of 1 kilometer; (2) conduct parametric studies on system autopilots, airframes, control laws, and sensors toward conceptual definition of requirements to meet threats of the 1990s; and (3) investigate the utilization of phase conjugate mirrors for high-energy laser (HEL) beam quality control. FY 1984 efforts will: (1) evaluate the compact matched filter optical correlator for autonomous missile target acquisition, discrimination, and guidance; (2) prototype a terminally guided submunition correlation seeker to provide fire-and-forget attack capability; (3) integrate a photonic computer into a FOG-M simulated data link and assess its operational capability; (4) acquire propagation data base over one kilometer path for 330GHz radar beam in clear and inclement weather; and (5) evaluate new HEL concepts such as explosively pumped laser for single-shot kill applications.

11. (U) AH51 — Combat Support Research: The Mobility Equipment Research and Development Command performs research in the basic mechanisms of various processes in fuels and lubricants such as fire suppression in fluids, environmental interactions of fuels, coolants, and lubricants relative to their performance characteristics. They also conduct research in power systems to develop a basic understanding of hydrocarbon electro-oxidation leading to efficient fuel cells and ultratrace vapor detection for countermine and mine-clearing applications. Significant FY 1982 accomplishments include: (1) a new type of radar-attenuating paint based on dipole segments and an antilaser camouflage paint that absorbs laser radiation were successfully tested, (2) correlated self-extinguishing mechanisms for diesel fuel, and (3) simulated mine structure response to blast overpressures. FY 1983 efforts seek to demonstrate high efficiency in highly energetic plasma research on fuel deterioration effects, heteroatom effects on combustion, and grease thickener/fluid interrelationships. FY 1984 efforts are planned to examine (1) available technology in biosensors for potential absorption of additives, (2) lubrication parameters for advanced engine systems, and (3) develop a quantitative theory to describe the microwave interaction and electromagnetic properties of camouflage materials to enhance the absorption of radar radiation by segments in camouflage cloth.

12. (U) AH52 — Support of Equipment for the Individual Soldier: The Natick Research and Development Laboratories have recently re-structured their scientific investigations into the following five areas: food research, interaction of micro-organisms with materials, interaction of photo/thermal energy with materials, fibers and fabrics for chemical warfare protection, theoretical and experimental techniques for airdrop and tactical shelters. In FY 1982 accomplishments include: (1) determined the need for caution in using significant levels of glycerol or sucrose in diets low in polyunsaturated fat; and (2) used radiometry as a rapid screening technique for determining the microbial quality of cooked, frozen foods within 6 hours as opposed to the conventional two-day technique. In FY 1983 most of the emphasis sought to explore the mechanisms for integrated chemical and biological protection and required heat transfer material, vulnerability to biodegradation, energy absorption by clothing, interaction with chemical protection, and sensory effects due to encapsulation. Secondary emphasis included microbial hazards, stability, and rehydratability of combat foods. FY 1984 efforts will evaluate: (1) the extent of immobilization of chemical agents in clothing by surface reactive and synthetic polymer materials; (2) the utilization of cyclodextrins in the catalytic degradation of chemical warfare agents; (3) the identification of factors that affect a toxin's stability; and (4) the first integrated evaluation of compact, lightweight ration as a baseline for the nutritional sustaining module.

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13. (U) AH60 — Research in Large Caliber Armaments: The Large Caliber Weapon Systems Laboratory investigates the behavior of energetic materials (explosives, propellants, and pyrotechnics) and physics of armaments (physics of failure and reliability, armament materials, systems structural analysis and munitions) for enhancing the lifetime and operational effectiveness of explosives, propellants, gun tubes, recoil mechanisms, and mounts. Significant FY 1982 accomplishments included: (1) the identification of a flash-suppressing additive which is ten times more effective than hitherto achieved; (2) the characterization of candidate new igniters, initiators, and explosives; (3) demonstrated the use of ductile chromium and tantalum alloy for reducing gun tube erosion; and (4) the identification of aluminum and thallium as good gun tube wear coatings. Primary FY 1983 efforts seek to (1) utilize a detonation calorimeter to evaluate the effectiveness of additives in enhancing the detonation output; (2) synthesize octanitrocubane and related high-density, high-output explosives; (3) identify the physical variables contributing to dynamic response of the cannon/projectile systems to firing; and (4) solve the fracture mechanics of multiple cracks in cylinders and modeling of muzzle blast involving chemical interaction. FY 1984 efforts will seek to (1) theoretically calculate the utility of candidate liquid-propellant materials, (2) demonstrate a mathematical model for optimizing cooling for compression-loaded munitions, and (3) improve the physical and mechanical properties of chromium, calcium, and molybdenum alloys made through rapid solidification technology on linear materials for erosion control in advanced barrels.

14. (U) AH61 — Research in Fire Control and Small Caliber Armament: The Fire Control and Small Caliber Weapon System Laboratory conducts research in the areas of materials, mechanisms for fire control and weapon control, small caliber ammunition and small caliber system evaluation to include electromagnetic propagation and processing, innovative optical and electronic techniques for target location, identification, and tracking, control theory of linear and nonlinear systems, and data sensor/computer interfacing with emphasis on realtime algorithms and fast covariance factorization techniques for rapid solution of the fire control equation, gun pointing and tracking. Selected FY 1982 accomplishments include: (1) the implementation of digital compensation filters for high-precision digital pointing and tracking systems, and for firing-on-the-move applications against evasive maneuvering targets; (2) the demonstration of basic planar optical waveguides capable of supporting optical modes at 10.6 microns for high-volume sensing and signal processing requirements; and (3) the confirmation of using a fiber optic interferometer as an acoustic sensor in the atmosphere. Primary FY 1983 efforts seek to (1) improve signal processing capabilities and weapon/turret stabilization techniques for tank fire control systems, (2) exercise mechanisms models to optimize weapon functioning evaluation and conceptual design parameters, and (3) refine the control system design model to account for structural dynamics associated with barrel flexure and other gun system nonlinearities to improve overall stability and aiming accuracy. Primary FY 1984 efforts will (1) be directed toward fire control computer process architecture to optimize processing speed and determine minimum word length to maintain accuracy and stability for implementing fast algorithms associated with realtime aiming controllers, (2) investigate partial shape recognition using curvature function of the target silhouette without any knowledge of distance to target so that targets can be instantly recognized from fragmentary images, and (3) evaluate syntactic expert techniques to permit autonomous control of multiple guns.

15. (U) AH63 — Research in Electronic Warfare: The Electronic Warfare Laboratory investigates the underlying physical phenomena associated with radar emitter targeting; the detection and identification of optical/electro-optical devices; chaff fundamentals by exploring broadband, tunable millimeter and optical sources; and thermal and laser means for jamming and spoofing. Primary FY 1982 accomplishments include: (1) the simulation

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and experimental verification of processing techniques for signal separation and interference recognition and (2) simulation of applicable super-resolution direction-finding processing techniques and extension of the algorithms for working with a circularly disposed antenna array. Primary FY 1983 efforts seek to: (1) conclude direction-finding processing and interference analysis; (2) improve autonomous adaptive radio or other electromagnetic source tracking and predictive algorithms to include modeling of various modulation versus complex/spread spectrum radars; (3) adapt the circular disposed antenna array processing concept to permit realtime super-resolution processing in high-density electromagnetic environments. FY 1984 efforts will (1) evaluate the acousto-optic encoder and coherent detection/processing model, (2) initiate holographically stored millimeter/submillimeter wave phased array antenna for emitter tracking, and (3) investigate the compatibility of dipole coatings used to coat chaff shanks as well as theoretically assess chaff signatures to determine how electronic warfare radiation is obscured by these materials.

16. (U) **AH68 — Processes in Pollution Abatement:** The US Army Toxic and Hazardous Materials Agency studies the fundamental physical, chemical, and biological mechanisms and kinetics involved in waste treatment technologies on Army-unique compounds. Significant FY 1982 accomplishments included: the controlled thermo-detoxification of munition wastes, hazardous chemicals, and other surplus materials to enhance recovery of reusable by products. FY 1983 efforts seek to treat munition wastes with super-critical fluids in order to yield acceptable environmental waste products and to study the plating reaction caused by encapsulation and fixation of hazardous wastes. A process research effort will be initiated in FY 1984 to control halide and other harmful air emissions that occur during the manufacture of munitions.

17. (U) **BS04 — Identification and Health Effects of Military Pollutants:** The Medical Bioengineering Research and Development Laboratory identifies the effect of military pollutant compounds on living systems. Accomplishments in FY 1982 include the evaluation of an immunologic test for predicting chronic toxicity effects and identification of short-term bioassay protocols to predict functional impairment resulting from toxic exposures. FY 1983 efforts seek to examine an aquatic model to evaluate chronic aquatic toxicity and to validate short-term mammalian bioassay to predict functional impairments from toxic exposures. Principal efforts for FY 1984 include final validation of environmental fate models and the completion of a model to provide rapid evaluation of the environmental hazards associated with Army-unique chemical spills.

18. (U) **BS12 — Science Base/Medical Defense against Biological Warfare (BW):** This new project was funded in prior years under Project Number BS10 and is broken out in FY 1984 to draw attention to the basic research necessary for an adequate medical defense against BW agents. In-house work is performed at the Army Medical Research Institute of Infectious Diseases. Accomplishments during 1982 include: the isolation and characterization of genetic material responsible for the production of specific substances that immunize against anthrax (a recognized BW agent); improved methods for the decontamination of equipment exposed to high levels of mycotoxin (the "yellow rain" agent); better laboratory procedures for the arraying of mycotoxins; and characterization of laboratory animal models for mycotoxin poisoning. Also during FY 1982, a large contract research program on biological toxins was established. FY 1983 emphasis is being placed on the application of biotechnology to enhance diagnostic, protective, and treatment measures against known BW agents by identifying candidate vaccine substances. In 1984 genetic engineering and

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monoclonal antibody technology will be applied to the development of improved identification and diagnostic procedures and research on hemorrhagic fever vaccines.

19. (U) AT22 — Research in Soil and Rock Mechanics: The Waterways Experiment Station provides fundamental knowledge on the physical properties and response of terrain materials important to military engineering and construction in a combat environment of permanent military facilities. FY 1982 accomplishments include the extension of the vehicle track-soil interaction model to include sinking in the soil for use in combat vehicle design; generation of algorithms for distinguishing mines from desert terrain backgrounds to assist in mine detection; and the establishment of automated interpretation techniques for evaluating geophysical data from field sites to improve foundation investigation for permanent facilities. Efforts in FY 1983 seek to determine the effects of soil suction on the strength of swelling soils to improve design reliability for military structures and to extend current rigid and flexible pavement design procedures for consideration of material variability. FY 1984 efforts will refine layered elastic design procedures used in pavement design to make them more accurate; establish procedures for suppressing terrain background signatures to aid in mine detection with visual and infrared systems; and generate models for predicting explosive blast propagation in tunnels and chambers.

20. (U) AT23 — Basic Research in Military Construction: The Construction Engineering Research Laboratory achieves technical solutions to specific problems in the planning, design, construction, operation, and maintenance of buildings and facilities on Army installations. Accomplishments in FY 1982 included: Verification of a technique to separate conduction and radiation heat exchange components necessary for predicting heating and air conditioning requirements in buildings and interaction analysis of functional components in heating, ventilating, and air conditioning control systems which anticipate and correct for changes in heating or cooling loads in buildings. FY 1983 efforts include: A technique to calculate building energy use based on realtime building measurements and the identification of cause and effect factors which describe the relationship between Army training activities and degradation of the training area. FY 1984 efforts will: characterize the ability of sensors to autonomously monitor realtime construction quality and define the parameters needed to enable the architect to verbally enter design data for computer-aided design of buildings.

21. (U) AT24 — Research in Snow, Ice and Frozen Ground: The Cold Regions Research and Engineering Laboratory represents the Army's only investment in cold weather research required to respond to materiel acquisition, training, and doctrine for cold regions requirements. FY 1982 accomplishments include: the prediction of river ice strength as a means to assess the feasibility of crossing over the ice, laying a tactical bridge over the ice or the need to reinforce river ice for crossing, and a theoretical solution of helicopter ice-release mechanisms and improved ice forecasting. FY 1983 efforts seek to improve the characterization of the effect of ice, fog, and airborne snow upon electromagnetic propagation; modeling of natural ice strengths; assessing effects of moisture migration upon strength and stability of frozen soil; modeling of terrain roughness; and the assessment of the effect of ground water upon the rate of frost penetration, heave, and soil thaw. FY 1984 efforts will generate models on natural ice and brackish

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ice along with the verification of the terrain roughness model; support the electro/optical and millimeter-wave weapon designers through the generation of a preliminary model on the optical properties of airborne snow, ice, fog, and snow on the ground; and contribute to efforts to resolve problems in training, combat operations, and construction and maintenance of permanent military facilities in cold regions.

22. (U) **A31B — Night Vision and Electro-Optics Research:** The Night Vision and Electro-Optics Laboratory exploits new and improved technology for imaging concepts as needed by lasers and all-weather vision systems for surveillance and fire control with emphasis in the scientific areas of image intensifiers, thermal imaging, uncooled detectors, high-density detector arrays, image processing, and solid state and gas lasers including near-millimeter lasers. Significant FY 1982 accomplishments include: (1) the completion of a revolutionary uncooled imaging approach; (2) the operation of an optically pumped near-millimeter wave laser in both super radiant and unstable resonator cavity configurations; (3) the simulation of a multiple target tracking, acquisition, and maintenance algorithm for critical airpoint and detection of moving targets against a moving background, and (4) found first evidence of high recombination at the mercury-cadmium-telluride/cadmium-telluride interface which profoundly affects infrared detection capabilities. Primary FY 1983 efforts seek to examine wideband tunable laser techniques, compact infrared electro-optical and nonlinear materials capable of modulating the spectral, spatial, or temporal content of 3 to 5 or 8 to 14 micron radiation, and validate bounding techniques for the cueing state variable tracker model. FY 1984 efforts will concentrate on developing algorithms for model verification and the fabrication of devices and focal plane arrays for evaluation in support of fully autonomous vehicular activities involving a multisensor automated target acquisition and tracking system.

23. (U) **B52C — Research in Geodetic, Geographic, and Mapping Sciences:** The Engineer Topographic Laboratories is concerned with the impact of mapping, surveying, photo interpretation and other forms of geographic information upon military systems to include the deployment of topographic instruments, systems, and techniques. Significant FY 1982 accomplishments included: the use of radar data as a means of extracting terrain features by semiautomatic means for combat planning and the improvement of the launch gravity model for ground- and air-launched missiles to account for astrogeodetic effects. Primary FY 1983 efforts seek to enhance autonomous processing of topographic and terrain data and investigate statistical and syntactical pattern recognition techniques to automate feature extraction and identification from background clutter. FY 1984 efforts will evaluate basic technique to digitize, process, and analyze imaged terrain features; complete the optimum gravity model for strategic missiles; and initiate subterranean detection of tunnels by gravity gradiometers.

24. (U) **B53A — Research in Atmospheric Sciences:** The Atmospheric Sciences Laboratory investigates the characterization of atmospheric dynamic phenomena that affect the performance of millimeter wave, high-energy lasers and low-energy laser devices, as well as smoke deployment, remote sensing, and aerosol physics. Typically atmospheric behavior data enable the construction of a theoretical framework and data base to validate potential weapon performance in degraded environments. Significant FY 1982 accomplishments include: (1) the determination of polarization and refractive index of snow and raindrop shape effects on millimeter waves; (2) verification of an algorithm for the vertical structure of visibility profiles in Europe; and (3) measurement of the ratio of absorption to total scattering for dust in the 3 to 5 micron and 9 to 11 micron regions. In FY

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1983, efforts seek to: (1) theoretically define rain polarization for millimeter waves; (2) model chemical obscuration behavior incorporating wind and turbulence for complex terrain; (3) relate meteorological effects of smoke, dust, and fire products to visibility parameters; (4) refine computer programs for vertical structure and slant path transmission in fogs and smokes; and (5) quantify the adverse weather and limited visibility conditions as a means to circumvent the effects on weapon systems in near-realtime. FY 1984 efforts will generate improved models to analyze nuclear, biological, and chemical materials deployed in complex terrain; design environmental sensors for passive and active earth boundary layer sensing; and validate a battlefield smoke model to include realistic effects on performance of electro-optical systems such as night vision devices.

25. (U) A71A — Research in Chemical/Biological Warfare Defense: The Chemical Systems Laboratory provides DOD fundamental focus in support of new or improved defensive systems against biological and chemical threats by establishing scientific approaches to detection, identification, and decontamination techniques. Significant FY 1982 accomplishments include: (1) the adaptation of an immobilized enzyme method for virus detection and the demonstration of a peroxidase linked specific antibody technique to detect tissue cell fragments; (2) the reaction of monoclonal antibodies produced for paraoxon soman and T-2 mycotoxin with tissue cultures; (3) the litmus detection of endotoxin from gram negative bacteria; and (4) the production of counter clouds for biological agent decontamination. Primary FY 1983 efforts emphasize prompt reaction to potential biological and chemical threat environments by (1) measuring absorption, scatter, and humidity effects of biological aerosols, materials, and toxins; (2) determining properties of thickened liquids, viscous film, and surface transient response to substances that are likely to control physical behavior during decontamination; and (3) performing spectroscopic investigations of atmospheric agent reactions to verify reaction activation energy. FY 1984 efforts will investigate polarography using pulse and derivative techniques to study the reaction rate of fluorescence production as a function of bacterial concentrations and the use of characterized and systematically varied polymer composition or structural variables on the transport behavior of chemical agents and decontaminants relative to the support of chemical, biological, and toxin defense materials, deterrence and inherent limitations of aerosol and obscurants upon electro-optic and other weapon systems.

26. (U) B74A — Research in Human Engineering: The Human Engineering Laboratory conducts research that focuses on achieving a more thorough knowledge of the behavior of soldiers, incorporating their findings into the design of Army materiel to improve effectiveness. Significant FY 1982 accomplishments include: (1) The quantification of pictorial and textual material effects on eye movement to provide insight into general information-processing capabilities; (2) completed data analysis on electrophysiological recordings of previous research to assess the effects of high-intensity light on auditory information-processing; (3) conducted experiments on the internal representation of events in memory. The results of this research will be applied to and affect most command and control (C²) and command, control, and communication (C³) systems designs. The FY 1983 program will focus on experiments to obtain more knowledge about the human, per se, that is fundamental to the human engineering of vehicles and other systems. Emphasis will be placed on experiments to determine the effects of auditory and visual interactions on human information-processing; the role of eye movements in visual search; and comprehension of information from charts, displays, and texts. Emphasis will also be applied to research in learning and memory processes, motor skills, and the reading ability of the soldier. The principal FY 1984 thrust will be to conduct experiments to determine optimum methods for information transfer with primary emphasis on C² and C³ systems. Auditory and visual information-processing during

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periods of high stress will be examined, and HEL will begin to integrate the resultant data. Behavioral and developmental research will be conducted on reading problems. Preliminary results will be applied to the Army Ordnance School program to determine their impact on improving reading. Research will also focus on comprehension, search, learning, memory, and information-processing and control in closed-loop systems.

27. (U) **B74F — Personnel, Performance and Training:** The Army Research Institute applies the behavioral science base to improve future effectiveness of soldiers and materiel systems by fostering methodical assessments of manning and maintaining the force, manned systems integration, training for combat effectiveness, organizational cohesion and commitment, and operational effectiveness of systems. Significant FY 1982 accomplishments include: (1) the utilization of computer-adaptive testing methodology to evaluate the level of an individual's knowledge in any given area; (2) the application of decisionmaking and fault diagnosis procedures to achieve an efficient means to train potential maintenance personnel in troubleshooting using analytic problem-solving routines; (3) the qualification of strategies for intelligent computer-adaptive instructional systems to automatically provide a tutor route for bringing the soldier's current state of subject comprehension closer to the so-called "ideal" level of comprehension; and (4) the characterization of human performance variables and human activities, to include command decisionmaking and combat target acquisition having the most impact on combat outcomes, thus providing a means to evaluate doctrine, policy, and equipment allocation using simulation modeling. Primary FY 1983 efforts seek to emphasize analytic measures for human information-processing (intelligence) as needed to optimize instructional learning strategies, the effects of uncertainty and stress on group decisionmaking, and the utilization of artificial intelligence techniques for expert maintenance and tactical decisionmaking for command-control-communication/intelligence scenarios by focusing on such areas as flexible adaptive systems for planning and the allocation of combat resources. Principal FY 1984 efforts will optimize the utilization of individual learning strategies and analytic measurement of intelligence, and initiate a computer-based instruction for training of psychomotor skills to include measurement criteria of manual skills required to complete Army Military Occupational Specialty training.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) **Project: BH57 — Research in Scientific Problems with Military Applications**

a. (U) **Project Description:** The Army Research Office (ARO) supports basic research in physical science and engineering to foster new and original application of scientific knowledge to the spectrum of Army needs. To achieve this goal, support is provided in the following categories: (1) University Research Instrumentation, (2) Electronics, (3) Chemistry, (4) Mechanics and Aeronautics, (5) Physics, (6) Materials, (7) Mathematics, (8) Atmospheric and Terrestrial Science, and (9) Biological Science. Items (1) and (2) represent projects over \$10 million, and each will be discussed separately while projects (3) through (9) are summarized together under the heading of other as they each fall below a threshold level of effort. Synergistically, this project seeks to increase knowledge related to national security needs and to the solution of identified military problems. It provides, in part, the scientific base for subsequent exploratory and advanced developments in defense-related technologies and for new or improved military functional capabilities in the technology areas such as Chemical/Biological Warfare Defense; Microelectronics; Millimeter Waves; Adverse

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Weather; Fire Control and Imbedded Computer Software; Gun Propulsion, Explosive and Shock Phenomena; Command, Control, Communications, Intelligence; Surveillance and Target Acquisition; Vertical Lift; and Armor and Antiarmor. This project supports outstanding scientists in universities, research institutes, and industry. To achieve continuity of the mid- to long-range program, a three-year review cycle has been established. This review cycle provides an in-depth review, on a rotating basis, of each research category once every three years with secondary reviews each year. A three-year cycle allows a research effort to mature to the point where the review will be meaningful, yet insures that the effort continues to address relevant Army problems.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments:

(a) (U) **University Research Instrumentation:** This program is a new start in FY 1983.

(b) (U) **Electronics:** Significant FY 1982 accomplishments include: (1) Techniques for the molecular beam epitaxial growth of gallium phosphide for high-performance transistors, (2) new contact techniques and computer-simulated process-modeling required for the next generation of submicron geometry integrated circuits, (3) a technique for analytical error compensation in near field antenna array measurements for high-performance radar systems and high-resolution microwave imaging technique utilizing large, random, sparse arrays.

(c) (U) **Other projects:** Additional significant accomplishments for FY 1982 are numerous. Representative samples of accomplishments are: phase transformation in steel which yields a fibrous aligned martensite structure resulting in tougher steels for armament and munitions; triple-constituent multilayer heterostructures which offer new materials (super lattice) which lead to a new class of high-speed semiconductor devices; established electrochemical techniques for chemical warfare agent detection; identification of an enzyme which hydrolyzes certain types of nerve gases; use of distinct analytical and predictive techniques for the study of shock wave formation of projectiles as they pass through muzzle blast; successful computer models to predict heat and moisture transport in freezing and thawing ground; and combustion measurements of ejector and cylinder dynamics for diesel engine ignition to improve engine performance.

(2) (U) FY 1983 Program:

(a) (U) **University Research Instrumentation:** This new program, along with equal emphasis from the Navy and Air Force, will provide the opportunity to reverse the trend of growing obsolescence of university research instrumentation.

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(b) (U) **Electronics:** The Electronics program addresses the five general areas of distributed command, control, and communications; microelectronics; target acquisition; fire control/weapon guidance; and computers. Typical areas of research investigation included in the program are: theory and design of large complex distributed dynamic communication networks; low-probability-of-intercept and jam-resistant communications; optical communications; and adaptive and conformal antenna arrays. Additionally, research effort is placed on millimeter to submillimeter wave integrated circuits. A major component of the effort focuses upon ultra submicron electronics and computer-aided design for VLSIC (Very Large Scale Integrated Circuits) devices and signal processing utilizing VLSIC devices to include supporting areas of distributed and concurrent signal processing and software design and reliability for embedded computer systems.

(c) (U) **Other Projects:** Other principal efforts include the following: A university fellowship program to support doctoral candidates pursuing research topics of vital interest to the national defense where critical shortages of personnel exist; the investigation of properties of steel and nonequilibrium materials for military applications and materials with superlattice-like structures for tailoring the performance of integrated circuit devices to meet military requirements; physics of shock wave phenomena, projectile penetration and ultra high loading rates; high-energy lasers with the associated power-conducting techniques; mathematics related to large-scale computation and associated software development techniques; and optical signal and image processing techniques for weapon control and guidance.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request:

(a) (U) **University Research Instrumentation:** This program was initiated in FY 1983. In FY 1984, universities will again be invited to submit proposals for consideration. With the severely deteriorated state of university research instrumentation, a multiyear effort is required to alleviate this problem.

(b) (U) **Electronics:** Efforts will continue in the areas such as distributed network design and control for large, complex, and rapidly changing distributed digital networks as envisioned for command and control of the future Army. Computers will play a large and costly role in complex systems; thus, emphasis will be placed upon software designs, testing, and reliability to reduce costs and increase maintainability. Microelectronic research will continue and include materials-processing for geometries in the order of 0.1 micron. Research to improve the performance of sensing systems including millimeter wave integrated circuits, high-resolution radar techniques, and materials such as mercury cadmium telluride for passive sensors.

(c) (U) **Other Projects:** Other efforts will seek to: Research materials for millimeter/submillimeter wave solid state devices for sensor applications; target signature and clutter modeling for millimeter wavelength systems; small-radial flow turbomachine combustion for alternative fuel use and realtime control of combustion processor; physics of detonation and propulsion including high-impulse propellants, custom synthesis procedure for polymeric material, and blast wave loading of military structures.

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(4) (U) Program to Completion:

(a) (U) **University Research Instrumentation:** This DOD project represents a five-year thrust to upgrade the status of university research instrumentation to address high-priority research objectives. It was initiated in FY 1983 and will be completed in FY 1987.

(b) (U) **Electronics:** This is a continuing program to ensure that the Army is in a position to fully utilize research results obtained within this rapidly evolving, high-leverage technology.

(c) (U) **Other Projects:** This is a continuing program to ensure scientific coupling between the academic and military communities.

2. (U) Project BS10 — Research on Military Disease, Injury and Health Hazards:

a. (U) **Project Description:** This project provides the research base for DOD programs in infectious diseases and combat dentistry. Biotechnology research techniques in microbial genetics and molecular biology including recombinant DNA are being used to meet DOD requirements to create new protection against, and treatment for, infectious disease. This project provides the science base for the Army medical programs in combat casualty care and health hazard assessment of military materiel systems. Laboratories addressing these problems are: Walter Reed Army Institute of Research (WRAIR), Washington, DC; Letterman Army Institute of Research (LAIR), Presidio of San Francisco, CA; US Army Medical Bioengineering Research and Development Laboratory (USAMBRDL), Frederick, MD; US Army Institute of Surgical Research (USAISR), Ft Sam Houston, TX; US Army Research Institute of Environmental Medicine (USARIEM), Natick, MA; US Army Aeromedical Research Laboratory (USAARL), Ft Rucker, AL; US Army Institute of Dental Research (USAIDR), Washington, DC; Naval Medical Research Institute (NMRI), Bethesda, MD; and Naval Health Research Center (NHRC).

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments:

(a) (U) **Infectious Disease:** Reagents (monospecific antibodies) were prepared which permit identification of the four types of dengue virus (which causes a disease common in the tropics) in one-third the time using previous techniques. For the first time monoclonal antibody technology has also been used to prepare reagents against the organisms that cause meningitis and scrub typhus; both disease are documented military problems. Techniques were determined for increased recovery of material from mosquitoes. This material is needed for malarial vaccine preparation.

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(b) (U) Combat Casualty Care: A shock-inducing substance produced by the pancreas was identified. The role of specific cells (mast cells) in post-burn tissue swelling was determined. A biological molecule relating acute kidney failure with increased susceptibility to infection was identified.

(c) (U) Health Hazards: Acute elevations of fluid regulatory hormones were demonstrated during exercise in heat and may be essential for preserving plasmin volume. Endotoxin tolerance significantly decreased mortality rates for animals subjected to moderate heat stress. A novel compound was shown to reverse circulatory shock without altering morphine-induced pain relief.

(d) (U) Dental Injury: A moldable polymer material was synthesized for potential use as an emergency battlefield measure to stabilize wounded maxillofacial tissues and for surgical replacement of segments of lost bone. Antibiotic microcapsules were reformulated, and demonstrated a significant improvement in drug release for extended control of infection in maxillofacial wounds.

(2) (U) FY 1983 Program:

(a) (U) Infectious Disease: Mechanisms of virulence of infectious organisms are being examined to provide the basis for the construction of living attenuated strains or hybrids for possible use as oral vaccines.

(b) (U) Combat Casualty Care: Patient resuscitation, stabilization, and definitive treatment are being addressed by: documenting the site of inhalation injury and alterations in lung functions caused by burns; characterizing the physiological, biochemical, and hemodynamic changes caused by blast overpressure; refining acute kidney failure models as a result of hemorrhage and shock to investigate treatment to reverse or prevent shock.

(c) (U) Health Hazards: Efforts are focusing on basic mechanisms of heat injury, temperature-regulating mechanisms, and pharmacologic treatments. Vision research is examining the dark adaptation and contrast sensitivity. Mechanisms of hearing loss resulting from the operation of weapon systems are also being investigated. Impact physiology studies seek to focus on the secondary injury potential with body armor and material evaluation for improved helmet/head protection.

(d) (U) Dental Injury: Efforts are focusing on completion of baseline data ballistic studies of missile wounding effects to the maxillofacial area, investigations of the effects of biochemical and physical factors on the rate of wound healing, identification of the mechanisms of infection in maxillofacial wounds, and the formulation of biocompatible materials and therapeutic agents for wound treatment.

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(3) (U) FY 1984 Planned Program and Basis for Budget Year Request:

(a) (U) Infectious Disease: Monoclonal antibodies will be used to identify and locate the determinants on the surface of the virus particle required for antibody-mediated destruction of the virus. Monoclonal antibodies also will enable quicker diagnosis of disease infections in field laboratories. Recombinant DNA studies will be initiated that are designed to transfer the DNA of rickettsia that cause scrub typhus into a bacterial host; the goal of this technique is increased recovery of biological material used for vaccine preparation.

(b) (U) Combat Casualty Care: Cellular and organ alterations in shock, hemorrhage, burns, acute renal failure, blast overpressure, overwhelming post-injury infection and wound healing are yet undefined in their basic biochemical, metabolic, immune, and physiological reactions. These reactions must be clearly identified and understood before changes can be made to prevent or reverse them.

(c) (U) Health Hazards: Neurochemical mechanisms will be examined that are involved in the adaptation to stress incurred by combat operations/training. Close coordination is maintained with the Army Research Institute for the Behavioral and Social Sciences (ARI) in order to avoid duplication of effort. A near field model of blast wave interaction with the torso will be validated. Funds being requested are essential to establish and maintain data bases necessary to enable the applied development of techniques to attenuate materiel health hazards and stresses in addition to developing means to enhance soldier effectiveness.

(d) (U) Dental Injury: Investigations will concentrate on: ceramic and polymer materials for bone repair and microencapsulated therapeutic agents and battlefield wound dressings incorporating therapeutic agents for control of infection and pain.

(4) (U) Program to Completion: This is a continuing program for militarily relevant basic medical science.

3. (U) Project: BS11 — Chemical Warfare Effects and Antidotes

a. (U) Project Description: This project was funded in prior years as a part of project BS10. There are no changes to funding levels or basic research programs as a result of this restructuring. This project is the sole core basic research effort in medical defense against chemical warfare to eliminate major gaps in knowledge resulting from a decade of research inactivity. Research is designed to produce the basis for appropriate development of prophylactic, pretreatment, therapeutic, and soldier/casualty decontamination compounds to protect against chemical warfare (CW) agents. The Army is the Executive Agent for chemical defense research, and this scientific area represents the major DOD basic research effort on medical aspects of chemical defense; it supports the joint requirements of all Services. Research thrusts include: identification of sites and modes of action of CW agents and candidate pretreatment, prophylactic, antidotal, and therapeutic compounds, and skin decontaminants; determination of the efficacy and metabolic and biological fate of current and potential anti-CW compounds; determination of the neurological basis for symptoms of CW

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Program Element: 61102A

Title: Defense Research Sciences

DOD Mission Area: #510 — Defense Research

Budget Activity: #1 — Technology Base

exposure; use of immunological procedures to locate sites of action of both threat CW agents and candidate antidotes; definition of the dynamics of CW agent skin contamination through determination of the penetration rates, metabolism, and distribution of CW agents through skin; and exploitation of intrinsic protective ability of skin. In-house work under this project is performed at Walter Reed Army Institute of Research, US Army Research Institute of Chemical Defense, and Letterman Army Institute of Research.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) **FY 1982 Accomplishments:** A laboratory model has been developed to evaluate the effects of nerve agents on nerve cells. Dehydration was found to be a factor in increasing animal susceptibility to nerve agents. Preliminary procedures for production of monoclonal antibodies against nerve agents were established. The metabolic fate of several potential nerve agent antidotes was determined. The effects of nerve agents on brain cell functions continued to be documented. Observations in animals indicated that the kidneys may accumulate nerve agents in their metabolic breakdown products. Nerve agents and simulants were found to have different physiological effects on brain cells. The effect of Sarin on the heart was found to be mediated through actions within the central nervous system. Sarin has been shown to affect heart functions at lower doses than Soman. The direct effect of a promising pretreatment compound, pyridostigmine, on protecting nerve cells from nerve agents was documented. A naturally occurring enzyme has been isolated, and preliminary findings indicate a potential for deactivation of nerve agents.

(2) (U) **FY 1983 Program:** This project seeks to examine the basic mechanism of CW agents as the basis for development of potential antidotal compounds. The program is focused on: effects of nerve agents on the central and peripheral nervous systems; effects of environmental factors on performance after atropine administration; testing of protective qualities of monoclonal antibodies; use of monoclonal antibodies to detect localization of CW agents in the body; studies on the mode of action of potential antidotes; studies on the physiological effects by nerve agent on various organ systems of the body; the effects of long-term, low-dose nerve agent exposure; determination of skin penetration mechanisms of the various CW agents; initiation of studies on the inherent capability of skin to function as a natural barrier to CW agents; and identification of the critical biochemical properties required for compounds to function as topically applied skin barriers.

(3) (U) **FY 1984 Planned Program and Basis for Budget Year Request:** Efforts will support: pharmacologic, neuropathologic, biochemical, and physiologic effects of CW agents on both the central and peripheral nervous systems to determine the mechanisms through which threat CW agents cause death; the mode of action of CW agents on behavior will be examined; examination of the biological distribution of atropine analogs and metabolites in the body will be made; interactions between potential nerve agent antidotes and the binding of nerve agents to acetylcholinesterase will be explored; and the preliminary phases of the investigation of the metabolism of nerve agents in exposed animals will be completed. The response of cells in specific areas of the brain to nerve agent poisoning will be determined; the relationship between the effects of nerve agents on blood and brain acetylcholinesterase levels will be investigated; sites of action of candidate antidotes and chemical warfare agents will be identified; rates of skin penetration of the CW agents will be determined; the optimal way to enhance natural skin protection against CW agents

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Program Element: 61102A

Title: Defense Research Sciences

DOD Mission Area: #510 — Defense Research

Budget Activity: #1 — Technology Base

will be identified; blister agent metabolism, distribution, and toxic effects studies and studies of the interaction of the physiological control of the heart and respiratory systems with the effects of CW agents and antidotes will be made.

(4) (U) Program to Completion: This is a continuing program seeking broad solutions to the CW threat.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62105A

Title: Materials

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	13205	9588	12298	11394	Continuing	Not Applicable
AH84	Materials	13205	9588	12298	11394	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Work in this program element is directed toward satisfying specific Army needs. These include laminate material armor systems being developed to defeat conventional high-density, long-rod penetrators and shape charge munitions threats and to provide significant reduction in weight for a comparable thickness of conventional steel armor. These new armor systems will provide much greater protection than is currently available and also the lightweight, highly mobile capabilities required for advanced fighting vehicles. Work is being done to test and evaluate new equipment. Advanced metal-matrix composites are being developed for CH-47D-type helicopter transmission housings. The improved housings will have a mean time between removal greater than 3000 hours and will provide a reduction of 25% in operating costs and reductions in noise and vibration. Advanced metal-matrix composites are being developed for Army mobile bridging. This work will provide reinforcement packages to eliminate sag in mobile bridging for spans up to 52 meters. These metal-matrix composite kits will result in weight savings of over 50% with attendant increases in deployability, transportability, and emplacement effectiveness. materials structures capable of withstanding high-energy fluence levels in excess of at engagement times in excess of 5 seconds have been developed. These materials will be applied to Advanced Attack Helicopter and Cobra-type aircraft to provide laser protection in critical and vulnerable areas. Advanced gear and bearing materials are being developed to provide increased speed and higher payloads required for CH-47D-type helicopters. For optimum performance, these helicopters must have advanced gear materials that can withstand high torque at higher revolutions per minute and effectively operate at temperatures up to 600°F. Related Programs are in progress on rapid solidification technology applied to advanced powder metal alloys and the advanced surface processing methods of ion implementation to manufacture gears and bearings for highly stressed components in tanks and aircraft. Another critical mission program is the work to develop a systematic base on chemical warfare agents and associated decontaminant interactions with materials to support development of better equipment for the chemical, biological, and radiological environment. The work involves tests in the laboratory and equipment tests with chemical warfare agents to provide an accurate reference base. Specifications on the absorption, diffusion, and transmission properties of chemical warfare agents on materials for the XM-30 gas mask and other equipment are being developed.

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Program Element: #62106A

Title: Materials

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	13205	9588	12298	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	10450	9615	11551	Continuing	Not Applicable

Increase of \$2755 thousand in the FY 1982 funding level is a result of reprogramming to develop advanced compartmented armor materials for ground combat vehicles. The funding decrease of \$27 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTEA appropriation. Increase of \$747 thousand in the FY 1984 funding level is a result of program realignment to develop improved elastomers for tank track pads.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The Navy, Air Force, other Government agencies, and allied nations have complementary programs in one or more of these materials areas. Coordination within the Department of Defense is achieved through the Office of the Deputy Under Secretary of Defense Annual Apportionment Reviews and meetings of the Office of the Deputy Under Secretary of Defense Research and Engineering Ad Hoc Services Materials Laboratories Council. Coordination with the nonmilitary federal agencies is effected through participation in activities of the National Materials Advisory Board of the National Academy of Sciences, the Interagency Council on Materials and the Department of Defense Biannual Materials and Structures Briefings for Industry. International coordination is effected through the Technical Cooperation Program with Australia, Canada, New Zealand, and the United Kingdom, and the Structures and Materials Panel of the Advisory Group for Aerospace Research and Development of the North Atlantic Treaty Organization. There is no unnecessary duplication of effort within the Army or Department of Defense related to this program area.

F. (U) WORK PERFORMED BY: Approximately 47% on the development work on this program will be accomplished in-house at the Army Materials and Mechanics Research Center, Watertown, MA; Army Armament Research and Development Command, Dover, NJ; Army Missile Command, Huntsville, AL; Army Mobility Equipment Research and Development Command, Fort Belvoir, VA; Army Natick Laboratories, Natick, MA; Army Aviation Research and Development Command; Applied Technology Laboratory, Fort Eustis, VA; and the Army Test and Evaluation Command, Aberdeen Proving Ground, MD. The five primary contractors are: Garrett Turbine Engine Company, Phoenix, AZ; Parker Hannifin, Irvine, CA; Brown University, Providence, RI; Ford Motor Company, Dearborn, MI; and Massachusetts Institute of Technology, Cambridge, MA. There are eleven additional contracts with a total dollar value of \$4,170 thousand.

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Program Element: #62105A

Title: Materials

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: AH84 — Materials

a. (U) Project Description: The principal goals of this program are to produce new and improved materials that will withstand increased loads, and satisfy the environmental and structural performance requirements unique to Army weapon systems and equipment. Exploratory development is conducted in the following areas: Metallurgical techniques and alloy improvements, organic materials, ceramic materials, composite materials, mechanics of materials, laser hardening of materials, failure analysis, and test evaluation methods. All of these projects are aimed at producing materials specifications for use in Army systems and equipment to satisfy increased performance requirements, and to reduce the cost of weapon systems acquisition and lifetime ownership cost.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Determined graphite/magnesium (GR/MG) Metal Matrix Composite (MMC) corrosion effects and started to prepare GR/MG-MMC foils for the Battlefield Data System. Fabricated MMCs for engine applications, vacuum carburized gears/bearings for controlling surface hardness, installed powder metallurgy processing equipment, and demonstrated promise of casting repair via welding to significantly reduce rejection rate. Laser hardening work includes testing of metal-bearing resin, carbon-carbon composites, and filled organic composites as barriers. Determined ballistic/mechanical metal laminate properties. Penetrator materials developments include a new process to greatly improve properties of a uranium-titanium alloy, coatings for enhanced environmental protection of uranium, and completed stress analysis on large caliber sabots. Developed procedure for rifling ceramic gun tubes and began characterization of molybdenum alloy liners and powder metal alloys. Initiated product improvement program on powder metal aluminum alloys for artillery shell bases and ogives. Transitioned particulate-reinforced aluminum alloy development into Army helicopter components, transferred recommended specification changes on hydrogen embrittlement to Hughes Aircraft, and patented a preadhesion surface preparation treatment for steel. Textured steel armor materials moved into Manufacturing Technology phases for ground vehicles. Ballistically acceptable welds in ultra high strength steels led to procurement of helicopter seats with substantial cost savings. Initiated multihit capability study of tank frontal armors, determined interaction of long-rod penetrators with spaced armors and optimized steel-aluminum-Kevlar composite armors were applied to the M9 armored combat earthmover design. Completed spill suppression liner design for M113 Armored Personnel Carrier and M80 tank applications. Initiated cooperative effort to improve M1 tank armor steels. Demonstrations for vehicle structures include two molding techniques for large composite structures and the strength of glass fiber/polyester laminates, faced with steel, as effective armor. Characterized four candidate tank track pad elastomers, awarded contract on reinforced-plastic M113 roadwheel, and processed composites for lightweight track shoes. Developed family of glass-ceramics for adiabatic diesel engines. Patent disclosures issued on low-cost densification of carbon

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Program Element: #62106A

Title: Materials

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

fiber preforms, laser-tested ceramic composites and window/dome optical materials for missiles. Grew large Neodymium-Yttrium Aluminum Garnet (ND-YAG) crystals from which very efficient laser rods were produced. Obtained properties on silicon carbide/aluminum (SiC/AL) and silica fiber/aluminum (FP/AL) MMCs for bridging, and evaluated new structural concepts. Performed flammability assessment of fire-resistant polymers and developed lead/chromate-free, waterborne, corrosion-inhibiting primers. Evaluated personnel composite armor and photochromatic materials to solve out-of-band flash-blinding problem.

(2) (U) FY 1983 Program: Examine environmental effects on Blackhawk Kevlar/epoxy composites, conduct FP/MG corrosion work, investigate graphite/magnesium (GR/MG) composite interface and continue materials analysis of helicopter transmission case vibration. Examine processing effects on advanced gear steels, expand implant substrate system to include high-temperature titanium alloys for engines. Continue to develop design test data and methodology for laser and ballistic hardening, test crashworthy helicopter undercarriage concepts, and assess structural integrity of metal laminates after ballistic impact. Conduct tests on advanced tungsten alloys for penetrators and processing evaluations of new binary and polynary alloys and composite penetrators. Transition uranium-titanium alloy processing into processing advanced development. Fabricate composite sabots and apply new protective coatings to uranium-titanium penetrators. Gun tube and carriage developments include rapid solidification of powder metal barrel liners, first ballistic testing of rifled ceramic liners, fabricate prototype lightweight howitzer components and processing schedules for aluminum alloy and MMCs for lightweight compact armament systems. Munition materials developments include completing rapid solidified powder tool steel punches, surface treatment processing of steel ammunition parts, and study of 15B41 boron as a nonstrategic shell body material. Develop standard adhesives test and initiate deformation modeling task on ammunition belt links. Apply lightweight armor developments to High Technology Test Bed (HTTB), determine optimal configuration of frontal armors and transition into materials scale-up and structures, demonstration advanced development, and develop optimum weight armor for top attack protection. Upgrade/test spall suppression liners including radiological protection for M2/M3 and M60 applicability. Establish facility for in-process control of armor plate welding, and continue armor material design handbook efforts. Vehicle structures tasks include application of lightweight composites, developing battle damage repair techniques, improved fire resistance materials, and cure techniques for thick composites. Characterize track pad elastomers, design/analysis/fabrication of reinforced-plastic roadwheels and track shoe composite studies. Initiate net shape, cladless, hot isostatic pressing of ceramic engine components, continue glass/ceramic engine materials study, and examine opportunities to reduce M1 tank armor plate thickness. Test/evaluate carbon-carbon composites, perform analysis of penetrators, and conduct laser tests on optical and ceramic composite window/radome materials for missiles. Continue to characterize MMCs for bridging and evaluate joining techniques and developments of fire-resistant polymers for lightweight vehicles and coating systems. Develop composite systems for helmets and vests, and glass systems for canopies. Study ferroelectric materials for fast optical switches, complete flammability data base, and provide technical support on armoring executive cars. Initiate efforts on MMC radar antenna, radar-absorbing materials, and neutron/laser optics for electronics.

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Program Element: #62105A

Title: Materials

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Evaluate infrared spectroscopy for Non-Destructive Evaluation (NDE) of composites, study Kevlar creep behavior, compare vibrothermography with passive thermographic techniques and apply stress wave emission to curing large structural members. Examine silicon carbide/magnesium (SiC/MG) processing parameters, extend data base to fatigue of FP/A1 and SiC/A1 and investigate SiC/A1 fiber/matrix interface. Investigate powder compaction for bearing steels, vacuum carburizing of high-performance gear steels, and nuclear magnetic resonance for implant characterization. Perform laser and mechanical tests on Metal Bearing Resin (MBR) carbon-carbon and filled organic matrix composites. Determine Electroscan Remelted (ESR) and Vacuum-ARC Remelted (VAR) steel ballistic performance and undercarriage fabrication process. Transition tungsten penetrator processing techniques to processing advanced development and protection coating work on uranium penetrators into MMT. Conduct field tests on composite sabots and characterize high length/diameter performance of tungsten alloy and composite penetrators. Transition powder metal precursor gun barrel liners and lightweight howitzer component developments into 6.3A and aluminum alloy and matrix composite processing efforts into Army Helicopters. Commence firing tests on ceramic gun barrel liners and initiate corrosion study on advanced boron steels. Transition boron steel results to industry and the new steel punch into MMT for ammunition production lines. Complete multitarget composite armor requirements and tests on advanced materials for tank frontal armor and overhead protection, and install spall suppression/radiological liners in M2 and M60 combat vehicles. Transfer ARC-spectrum-based weld quality monitor to Manufacturing Technology Program. Investigate coatings to toughen laminate surfaces against abrasion and impact for vehicle structures. Determine ballistic damage resistance of fiber arrays, evaluate joining concepts, and study microwave and radio frequency dielectric heating for reducing cure cycle time for thick sections. Field test reinforced-plastic road wheels and molded elastomer track shoes, continue to develop glass ceramics and matrix composites, and initiate net shape sintering studies on engine materials. Optimize low-cost process for densification of 3-D carbon-carbon composites, fabricate/evaluate prototype window/radome materials, and test new penetrator alloys. Investigate elevated temperature and corrosion resistance of bridging MMCs and conduct structural tests of subscale components and joints. Perform synthesis studies on phosphazenes, develop fire-resistant, polymer matrix composites, and evaluate new coatings. Complete development of lightweight armor, develop prototype face shield, expand skin burn and uniform studies, synthesize chemical agent interactive polymers, and continue security protection support. Continue neutron work and initiate three-dimensional finite element studies of electronic integrated circuits packaging and materials developments on high-efficiency displays and signature reduction of power sources.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62111A

Title: Atmospheric Investigations

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	5034	5031	5812	6115	Continuing	Not Applicable
AH71	Atmospheric Investigations	5034	5031	5812	6115	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Mission needs respond to: (1) the requirements for the Army to provide its own weather support forward of division for assessment of combat operations and weapon systems performance and for hydrologic and flood forecasting; (2) requirements for the Army to take the lead providing battlefield atmospheric characterization to all three Services (Army, Navy, Air Force); (3) requirements from the United States Army Field Artillery School to provide improved long-range artillery effectiveness; and (4) requirements contained in the Long-Range Research, Development, and Acquisition Plan, Office of the Deputy Chief of Staff for Research, Development, and Acquisition, June 1982, and the Atmospheric Sciences Laboratory Research Plan, 1982, derived from addressing battlefield concepts contained in Air-Land Battle 2000. This program addresses the urgent need to develop meteorological techniques and equipment essential in the planning and support of combat operations to maximize combat effectiveness. Adequate knowledge of meteorological effects and adequate procedures and equipment to compensate for them are essential for optimum weapon performance and effective tactical operations. Near-realtime weather intelligence is essential in combat operations planning and weapons systems deployment. Specific objectives are to: (1) develop meteorological techniques and equipment for direct and indirect support of electro-optical and target acquisition systems, armor, smoke, high energy laser, and artillery precision-guided munitions; (2) establish and correct deficiencies in existing capability to assess and simulate, through models, the effects of dirty battlefield environment on performance of current and future electro-optical and near millimeter wave weapon systems; (3) provide quantification of potential battlefield atmospheres at wavelengths from visible to near millimeter; and (4) develop remote atmospheric sensors to provide timely battlefield environment intelligence.

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Program Element: #62111A

Title: Atmospheric investigations

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	5034	5031	5812	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5534	5045	6995	Continuing	Not Applicable

The funding decrease of \$500 thousand in FY 1982 is a result of reprogramming to higher priority Army requirements. The decrease of \$14 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. The decrease of \$1183 thousand in FY 1984 is a result of reprogramming to higher priority programs and revision of anticipated inflation.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Program Elements #61101A (Atmospheric Sciences); #62730A (Cold Regions Engineering Technology); #63741B (Meteorological Equipment); and #65702A, (Support of Development Testing). Work is coordinated within the Department of Defense by the Under Secretary of Defense for Research and Engineering (USDRE). Direct coordination is maintained with the Corps of Engineers; Project Manager, Smoke/Obscurants; Project Manager, Control and Analysis Center (CAC); Army Materiel Systems Analysis Activity; US Army Training and Doctrine Command; Night Vision and Electro-Optics Laboratory; Harry Diamond Laboratories; High Energy Laser Systems Project Office/Missile Command; Test and Evaluation Command, White Sands Missile Range (WSMR); Dugway Proving Ground; Air Force; Navy; National Oceanographic and Atmospheric Agency; Environmental Protection Agency; Panel IV of the NATO Research Study Group 15 (Action Committee 243); Panel XII (Meteorology) of the NATO Army Armaments Group and the US Army European Mesometeorology Advisory Panel to exchange information and preclude duplication of effort.

F. (U) WORK PERFORMED BY: The Atmospheric Sciences Laboratory, White Sands Missile Range, NM, is the in-house developing organization responsible for the program. The FY 1983 program is planned for approximately 75% of funding to be in-house, and 25% contractual. The top five contractors are: Physical Science Laboratory, New Mexico State University, Las Cruces, NM; Optimetrix, Ann Arbor, MI; University of Dayton, Dayton, OH; Science and Technology Corporation, Hampton, VA; and Aerodyne Research Inc., Burlington, MA. Contracts exist with eight additional contractors. The total contractual amount for FY 1983 is \$1,178,000.

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Program Element: #62111A

Title: Atmospheric Investigations

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

G. (U) **PROJECTS LESS THAN \$10 MILLION IN FY 1984:** AH71 — Atmospheric Investigations: This program addresses the following Army needs (1) to insure that the atmospheric impact on military systems has been properly treated; (2) to develop techniques to improve the effectiveness of Army systems under realistic battlefield conditions; (3) to develop techniques to mitigate atmospheric effects; (4) to develop atmospheric sensors that can be integrated into other Army multipurpose systems; (5) to develop meteorological measurement systems for characterizing battlefield environments; and (6) to provide atmospheric-related tools for system performance evaluation, wargaming, weapons design, and to assist the battlefield commander in his preparation for battle. Accomplishments in FY 1982 include: (1) The development of new modules for the Electro-Optical Systems Atmospheric Effects Library (EOSAEL). EOSAEL provides field-validated models used in wargames and weapons design, development, and testing. (2) The development of a High Energy Laser Meteorological Support System. (3) The documentation of systematic tank firing errors due to refraction, and development of a correction model to improve first-round accuracy of tank fire. (4) An automatic handheld meteorological lidar to measure visibility from a single-point source. (5) A smoke munition expenditure model (KWIK) was validated. FY 1983 goals include: development of worldwide scale models and data bases to produce a Global Electro-Optical Systems Environment Matrix (GEOSEM); determination of high energy laser firing windows to give significant increases in weapon performance; development of an advanced aerosol diffusion model and a large-area smoke screening model; integration of the high energy laser meteorological system into the systems test facility; development of a smoke munitions expenditure model for multispectral obscurants; development of Battlefield Atmospheric Transmission and Terrain Effects Library (BATTEL 83) models addressing the obscuration effects of dust and smoke under realistic terrain and vegetative conditions. FY 1984 goals are to: determine effects of rain and explosion debris on doppler signature classifications and identification; configure a system to automatically sense battlefield contaminants; extend geographical coverage of EOSAEL to Mideast and tropics; develop sensor concepts for remotely piloted vehicles to measure target area meteorology; demonstrate the atmospheric effects on automatic target detectors and classifiers; complete and distribute a chemical depiction model to Army users; develop a NATO chemical biological defense meteorological message; complete specific models of chemical biological transport and diffusion for terrain types of Army interest.

H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:** Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62120A

Title: Nuclear Weapons Effects/Fluidics

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	8050	6514	9923	8558	Continuing	Not Applicable
AH25	Nuclear Weapons Effects Research, Near Millimeter Wave Technology, Fluidics Technology	8050	6514	9923	8558	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Army urgently requires battlefield equipment that is survivable in a nuclear environment. The soldier can be effective in the battle even after being exposed to severe nuclear environments. Equipment must be as survivable as the soldier if the Army is to avoid the potentially disastrous situation of having soldiers who are willing and able to fight after surviving a nuclear attack but are unable to do so because combat systems fail to withstand the hostile nuclear environments. A survivable Army force provides a strong nuclear war deterrent. Environmental definition, vulnerability assessment, development of hardening fixes, and evaluation of the nuclear survivability of operational forces are parts of the Nuclear Weapons Effects research program. The approach is to develop, maintain, and transfer to the materiel developers the technology for balanced hardening of fielded and developmental systems. Near Millimeter Wave (NMMW) radars offer a potential way to see through the smoke and obscurants of the modern battlefield. This capability is critical to the Army when fighting outnumbered against forces heavily reliant on obscurants for cover in the attack. The fluidic technology program provides a coordinated, Army-wide program for the design, development, testing, and feasibility demonstration of fluidic activated control systems for use in Army materiel. Compared to electronics systems, fluidic systems can provide enhanced survivability in the nuclear environment and offer the potential for greatly improved reliability, availability, and maintainability, and reduced life-cycle costs while providing improved end item performance. An additional, though complementary, area of investigation in High-Power Microwave (HPM) technology provides the opportunity to increase understanding of the high-frequency electromagnetic energy region and its potential application as a directed energy source.

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Program Element: #62120A

Title: Nuclear Weapons Effects/Fluidics

DOD Mission Area: #523 -- Engineering Technology (ED)

Budget Activity: #1 -- Technology Base

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	8050	6514	9923	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5225	6532	11381	Continuing	Not Applicable

In FY 1982, the program was increased \$2825 thousand by reprogramming action to rectify several deficiencies in the basic vulnerability and hardening technology efforts and the nuclear delivery mission vulnerability and hardening activities. This funding increase also provided for the initiation of investigations in High-Power Microwave (HPM) technology. The funding decrease of \$18 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTEA appropriation. In FY 1984, a \$939 thousand decrease was based upon alignment of program requirements and priorities with available resources. The remaining FY 1984 reduction of \$519 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Nuclear weapon effects research is part of a tri-Service effort in coordination with the Defense Nuclear Agency. It is related to Program Element (PE) #63604A (Nuclear Munitions and Radiacs), which provides for technological assistance to materiel development agencies. All appropriate Army programs for missiles, combat vehicles, communications systems, and battlefield intelligence systems are supported by these efforts. The Near Millimeter Wave (NMMW) technology program is coordinated with research activities in PE #61102A (Defense Research Sciences) and other US Army Electronics Research and Development Command programs. Fluidic technology follows up on research in PE #61102A (Electronics, Sensors, and Signal Processing).

F. (U) WORK PERFORMED BY: Harry Diamond Laboratories, Adelphi, MD; Ballistic Research Laboratory, Aberdeen Proving Ground, MD; US Army Electronics Research and Development Command, Fort Monmouth, NJ; US Army Missile Command, Redstone Arsenal, AL; White Sands Missile Range, NM; Air Mobility Research and Development Laboratory, Fort Eustis, VA; US Army Mobility Equipment Research and Development Command, Fort Belvoir, VA. Primary Contractors include Science Applications, Albuquerque, NM, and La Jolla, CA; Mission Research Corporation, Santa Monica, CA; Braddock, Dunn and McDonald, McLean, VA; Research Triangle Institute, Raleigh, NC; and Garrett Pneumatic Systems, Phoenix, AZ. Approximately eight additional contractors are involved in this program effort with a total dollar value estimated at \$150 thousand.

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Program Element: #62120A

Title: Nuclear Weapons Effects/Fluidics

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AH25 — Nuclear Weapons Effects Research, Near Millimeter Wave Technology, Fluidics Technology: The Nuclear Weapons Effects (NWE) research program is an integral part of the Army Nuclear Survivability Program. The NWE research program is structured to provide adequate environmental definition for all nuclear weapon effects, to develop appropriate hardening fixes, and to provide technology for including nuclear survivability hardening during design and testing of systems in development or that are being product-improved. This is the Army's only program to provide the technology that enables development of equipment that will be survivable on the tactical nuclear battlefield. Near Millimeter Wave (NMMW) systems can provide better resolution of military targets than longer wavelength microwave systems. They are less affected by smoke and fog than electro-optic systems. The NMMW Technology Program will fill existing data gaps, develop NMMW measurement standards, and investigate new NMMW all-weather systems. Fluidics offer low-maintenance, high-reliability, intrinsically safe control systems that can operate in harsher environments than other types of controls, and are adaptive particularly to controls for missiles and remotely piloted vehicles, gas turbine fuel controls, turret stabilization systems for armored vehicles, and inertial navigation sensors. This program explores the applicability of fluidics to candidate systems sufficiently to demonstrate the feasibility of transferring technology to system development as cost-effective improvements. The High-Power Microwave (HPM) Technology Program investigates high-frequency microwave coupling phenomenology and the feasibility of applying this directed energy source in a tactical battlefield environment. In FY 1982 prototype hardware fixes were developed for the Missile Minder System (AN/TSQ-73) and validation testing for the field-applied electromagnetic pulse (EMP) fix on the AN/PRC-77 radio was completed. High-altitude EMP (HAEMP) test support was provided on the Position Location and Reporting System (PLRS) and analysis initiated on the AN/TSQ-73. Initial radiation studies and blast testing were completed on selected Mobile Electric Power (MEP) units for communications systems. Computer-aided design procedures for planar conformal NMMW antennas were developed. 94-gigahertz (GHz) linear arrays and two-dimensional lower frequency scale models were demonstrated, and a 94GHz antenna model was completed. Initial High-Power Microwave (HPM) tests were conducted on selected systems. A fluidic rate gyro was designed, fabricated, and tested, a fluidic-to-electrical interface was demonstrated, and a low-noise fluidic power supply model was tested. In FY 1983 continue vulnerability assessments and work on application of product improvements to equipment critical to the nuclear delivery mission, operation and improvement of existing Nuclear Weapons Effects (NWE) simulators, and transfer of base technology to developers of hardened Army systems. Initiate designs for a Large Blast/Thermal Simulator (LB/TS) and source region electromagnetic pulse (SREMP) simulator. Complete Battlefield Signal and Information Processing (BSIP) system software design, and begin applications and communications software design. Complete construction of a prototype Near Millimeter Wave (NMMW) collection receiver. Complete initial High-Power Microwave (HPM) testing of selected systems and initiate design studies for a tactical HPM directed energy source. Complete final design of a low-cost fluidic rate gyro for a Fluidic Heading Reference Unit (FHRU). In FY 1984 initiate hardening efforts for new Army multichannel communications systems and automated data processing (ADP) assemblies critical to the nuclear mission, and begin detailed vulnerability assessment and hardening using analysis and testing to all Nuclear Weapons Effects (NWE) for selected/netted Intelligent Surveillance and Target Acquisition (ISTA) systems critical to the nuclear mission. Continue and expand on detailed analysis and testing of selected elements of major Army Air Defense (AD) systems and their associated Mobile Electric Power (MEP) and ADP equipment and begin development of nuclear Hardness Assurance and Hardness Maintenance methods for tactical systems. Continue development of nuclear hardening and survivability verification techniques, support and improvement of existing NWE simulators to include development of blast/thermal instrumentation and installation of improved electromagnetic pulse (EMP) instrumentation,

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Program Element: #62120A

Title: Nuclear Weapons Effects/Fluidics

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

and a Large Blast/Thermal Simulator (LB/TS). Improve Near Millimeter Wave (NMMW) measurements and instrumentation procedures and characterize NMMW propagation in smoke/snow and moderate/heavy rain. Fabricate Battlefield Signal and Information-Processing (BSIP) hardware, and complete applications and communications software design. Design high-resolution 94- and 220-gigahertz (GHz) radars, and complete 220GHz transceiver system and antenna development studies for a Millimeter Wave (MMW) Remotely Piloted Vehicle (RPV) radar. Continue High-Power Microwave (HPM) technology investigations to determine the feasibility of design of a tactical HPM demonstration model. Continue development of a fluidic Heading Reference Unit (FHRU). A significant level of effort will be devoted in FY 1984 to support the Army's VISTA (Very Intelligent Surveillance and Target Acquisition) Program in the areas of radar technology, target correlation and fusion algorithms, and miniaturized information processors, as described above. FY 1984 funds in support of this program are essential to provide the Army with the technology and design capability to field systems and supporting equipment that are nuclear survivable and able to acquire and engage targets under all weather conditions.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62201A

Title: Aircraft Weapons Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	4000	2485	3132	3342	Continuing	Not Applicable
DH96	Aircraft Weapons Technology	4000	2485	3132	3342	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The work performed under this program element is essential to enable Army aviation to maintain a technology advantage and to increase the operational effectiveness and mission capability integral to successful conduct of the land battle. The objective is to provide the greatest possible weapons effectiveness at affordable cost in order to multiply the value of a single system through technology and compatibility with other systems. This is accomplished through the conduct of exploratory development which generates and demonstrates technical feasibility for application of advanced armament techniques and weapons on Army aircraft. Primary areas of effort include: development of lightweight cannon systems with a goal of 40 percent weight reduction from that of current systems; development of Television and Forward Looking Infrared (FLIR) image processing; improved air-to-air targeting techniques; and development of a magnetic helmet sight for use in both scout and attack helicopters.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	4000	2485	3132	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	2094	2492	3303	Continuing	Not Applicable

Increase of \$1906 thousand in the FY 1982 funding level is a result of reprogramming for a classified program beginning exploratory research. The funding decrease in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE,A appropriation. The FY 1984 decrease resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #62201A

Title: Aircraft Weapons Technology

DOD Mission Area: #525 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Close liaison is maintained with the other military services and industry to avoid duplication of effort. The Army participates in the Tri-Service Joint Technical Coordinating Group for Air Launched Non-Nuclear Ordnance, an organization chartered at the major field command level. This group provides a medium for exchange of technical information and determination of joint use implications and to minimize duplication of effort. An Army representative serves on the Air Munitions Requirements and Development Committee, an organization within the Office of the Secretary of Defense. One of the functions of this committee is the establishment of joint service requirements and development of air munitions. Related Advanced Development work is conducted under Program Element #63206A (Aircraft Weapons), and Engineering Development is under Program Element #64202A (Aircraft Weapons). Fire Control work is coordinated with other Army laboratories through the annual update of the US Army Materiel Development and Readiness Command's (DARCOM) "Fire Control Planning Guide."

F. (U) WORK PERFORMED BY: Contractors: Sperry Systems Management, Huntsville, AL; ARINC, Annapolis, MD; Teledyne Systems Co., Northridge, CA; Boeing-Vertol, Philadelphia, PA; Hughes Helicopters, Culver City, CA. In-house organizations: US Army Aviation Research and Development Command, St Louis, MO; US Army Armament Research and Development Command, Dover, NJ; and US Army Missile Command, Huntsville, AL.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: DH96 — Aircraft Weapons Technology: The purpose of the project is to strengthen the technology base of aircraft weaponry with particular emphasis directed toward filling technological voids and deficiencies identified by the aviation mission area analysis. The three technical areas under this project address weapon system concepts, fire control, and aerial munitions/rockets. FY 1982 accomplishments include: Completion of preliminary design of a magneto electric turret control which has the potential of improving weapon turret pointing accuracies by an order of magnitude; completion of a preliminary design for automatic cannon caliber target sensing armament; investigation into the feasibility of passively generating range to target utilizing television (TV) or Forward Looking Infrared (FLIR) sensor video in conjunction with an automatic target recognizer; investigation of guidance, control, and integration concepts for a low-cost, terminally guided 2.75-inch rocket. Technology investigations initiated during FY 1982 include: An evaluation of helicopter weapons technology which addresses both current and future weapon system requirements based on projected advancements in technology, threats, and tactics; development of lightweight compact armament with the objective of significantly reducing system weight; development of a weapon pylon concept which will minimize the HELLFIRE missile launcher motion caused by transient launch forces and rotor-induced vibrations (it is anticipated that a higher degree of weapon system accuracy as well as potential for a less expensive missile design due to an improved launch environment will result); investigation into the feasibility of an online fire control solution, wherein the ballistic differential equations are solved onboard the aircraft fire control computer in real time (this replaces the present technique of curve-fitting ballistic trajectories and eliminates the errors inherent in such curve fits); development of a base fuze for 30mm shaped charge munitions which has the potential of increasing armor penetration capability by 30% over standard nose-mounted fuze configurations. FY 1983 activities will complete the formulation of an automatic cannon air-to-air fire control mechanization initiated during FY 1981. Investigations will be

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Program Element: #62201A

Title: Aircraft Weapons Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

initiated addressing the feasibility and potential effectiveness of a low-altitude air-to-air proximity fuze which is immune to false targets presented by ground clutter. Potential of a hypervelocity flechette warhead in an air-to-air role will also be investigated. Development of a heads-up holographic sight capable of eliminating bore-sight parallax errors and a laser threat locator will be initiated. The magnetic helmet sight effort will explore the feasibility of using a magnetic sensing system for the helmet and sight correlation in lieu of mechanical and optical units currently being used. The purpose is to improve accuracy and obtain a system more compatible with chemical and biological overgarments. FY 1984 plans are to complete the helicopter weapons technology evaluation as well as development of the online fire control solution, holographic sight, threat laser locator, and variable stiffness pylon structure. An analysis of air defense suppression concepts and investigation into the feasibility of multisensor target recognition will be initiated.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62202A

Title: Aircraft Avionics Technology

DOD Mission Area: #521 — Electronic and Physical Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	5877	7278	8561	8180	Continuing	Not Applicable
AH85	Aircraft Avionics Technology	5877	7278	8561	8180	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Army aircraft must have the capability and flexibility necessary to perform a variety of missions in day, night, and adverse weather. In addition, the increased threat environment imposed by hostile forces requires enhanced survivability measures for new Army aircraft and to retrofit existing aircraft. The program provides the exploratory development technology base for intended Army avionics systems and related equipment for air-to-air and air-to-ground communications, environment sensing, controls and displays, improvement of helicopter man-machine interface, digital avionics, nap-of-the-earth (NOE) navigation, air traffic management/air space management, tactical instrument approaches, and command and control. Implementation of these integrated avionics systems will improve navigation, command and control, and reduce pilot workload. This permits greater concentration on mission tasks, threat detection, and evasive maneuvers. The key to providing this improved mission capability, survivability and flexibility is implementation of a standard multiplexed data bus interface (defined as MIL-STD-1553) and design of a modular, integrated, digital avionics system which will integrate the cockpit to reduce crew workload, provide increased ease of retrofit, and enhance survivability through redundancy. These improvements will allow use of integrated controls and displays and automation of routine functions to allow aircrews to concentrate on the tactical mission. Finally, lower cost and weight will result from these developments and provide benefits in improved aircraft performance, increased reliability, and lower life cycle costs.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	5877	7278	8561	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5867	8369	9404	Continuing	Not Applicable

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Program Element: #62202A

Title: Aircraft Avionics Technology

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

1. (U) FY 1982 — \$90 thousand decrease to fund higher priority Army requirements caused a decrease in The US Army Avionics Research and Development Activity's (AVRADA) share of joint development of color displays with the US Army Electronics Research and Development Command (ERADCOM) and the Navy.

2. (U) FY 1983 — \$1000 thousand decrease is a result of Congressional direction in the FY 1983 Appropriations Act, \$90 thousand decrease was a reprogramming of funds for the High Technology Light Division, and \$21 thousand as a pro rata application of general Congressional reductions to the RDTEA appropriation.

3. (U) FY 1984 — \$659 thousand decrease was reprogrammed to higher priority Army requirements, cancels the Multiple Aircraft Landing (MAL) program (\$350 thousand), and defers development of the hybrid Multifunction/Multispectral NOE Sensor (\$309 thousand). The remaining \$184 thousand reduction resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Tri-Service coordination of avionics developments and related programs is accomplished through Army membership and participation in committees and working groups such as: Acoustical Society of American Standards; Aircrew Station Standardization Panel; Air Standardization Coordination Committee; Tri-Service Airborne Multiplex Committee; Advisory Group for Aerospace Research and Development; and Radio Technical Commission for Aeronautics. Cost reduction is pursued through joint developments and hardware standardization. The US Army Avionics Research and Development Activity (AVRADA) is currently engaged in joint Service programs for the development of multicolor thin-film electroluminescent displays, and a Digital Map Generator for the Night Navigation and Pilotage System (NNAPS). The former program is a joint effort among AVRADA, Electronic Research and development Command (ERADCOM), NASA, and the Navy. The latter development is between AVRADA and the Air Force Advanced Fighter Technology Integration Program Management Office. A potential tri-Service development, currently under consideration by the Joint Service Review Committee (JSRC), is the present Air Force Digital Audio Distribution System (DADS). If adopted, DADS and the Digital Multiplexed Audio System (DMAS), now being developed by AVRADA, would merge into one program. AVRADA is also engaged in the development of aviation Command and Control (C²) systems in close coordination with the Communications-Electronics Command (CECOM), which has technical systems engineering responsibility for Army Command and Control Systems (ACCS). Incorporation of aviation C² into the ACCS is required to totally integrate Army aviation into the Combined Arms Team to act as a force multiplier for Air/Land Battle 2000. This program element provides the technology base for ensuing development in related Program Elements #63207A (Aircraft Avionics Equipment), #63221A (Nap-of-the-Earth Avionics and Navigation Equipment), and #64201A (Aircraft Avionics). There is no unnecessary duplication of effort within the Army or Department of Defense.

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Program Element: #62202A

Title: Aircraft Avionics Technology

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

F. (U) WORK PERFORMED BY: Raycomm, Freehold, NJ; United Technology Research, Hartford, CT; Sperry Rand, Phoenix, AZ; Harris Corp, Melbourne, FL; Vitronics, Eatontown, NJ; and six other contractors with contracts totaling \$1,385K through FY 1985. In-house developer is the US Army Avionics Research and Development Activity (AVRADA), Ft. Monmouth, NJ.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AH85 — Aircraft Avionics Technology: This project explores new concepts and techniques in aviation electronics to enable future Army aircraft to perform missions more efficiently and safely at low levels, at night, and under adverse conditions. Present emphasis is being placed on avionics system designs for the follow-on Light Helicopter (LHX) and block improvements of current aircraft. Exploitation of new technologies in such areas as Very High Speed/Very Large Scale Integrated Circuits (VHSIC/VLSIC) and artificial intelligence/robotics will be the basis for future avionics systems. They will greatly reduce pilot workload, allow flights in all weather, day or night, and operate on the dirty battlefield. FY 1982 — Continued contractual effort for feasibility hardware of the Digital Multiplexed Audio System (DMAS), which distributes digitally coded voice by multiplexed bus, improves installation time, minimizes the effects on TEMPEST, enhances intelligibility and reduces noise to the headset. Introduction of Voice Interactive Avionics (VIA) was initiated in FY 1981 and continued in FY 1982. Accomplishments include: evaluation of commercially available voice recognition hardware in a simulated Army aircraft noise environment. Participated in tri-Service development of multicolor thin-film electroluminescent displays. Pursued effort to obtain form, fit, function specification for an Attitude Heading Reference System (AHRS). Established system-level design for a navigation test instrumentation, data reduction, and software development facility. Pursued Decelerated Steep Approach and Landing (DSAL) effort. Performed initial evaluation of the Global Positioning System (GPS) to determine its landing capabilities. Pursued development of a compact CO₂ laser radar to support NOE flight profiles. POD I (it is shaped like a pod) was fabricated and will be installed in the Systems Testbed for Avionics Research (STAR) UH-60 aircraft for systems testing in FY 1983. A vibration sensor with potential for target identification was demonstrated. Identified information exchanges between aviation mission events and C² to establish an Army aviation C² architecture. Army Digital Avionics System (ADAS) display formats were completed for: flight data, engine data, caution/warning/advisory, aircraft survivability equipment, electrical system circuit breakers, eighteen secondary systems, and checklist and emergency procedures. FY 1983 — Complete exploratory development for DMAS and test the hardware in audio/acoustics facility. Evaluate commercial, speaker-dependent, connected-word equipment as part of the Voice Interactive Avionics (VIA) development program. Continue participation in multicolor thin-film electroluminescent displays by development of single-color, thin-film samples of green, red, and blue. Investigate requirements for nuclear and Electromagnetic Pulse (EMP) hardening of Army avionics equipment and protection of avionics equipment operating in high sand and dust environments. Assess the ability of the Global Positioning System (GPS) to provide landing guidance data to helicopters. Support the US Army Communications Command (USACC) in formulating Air Traffic Management (ATM) requirements. Initiate an algorithm development for vibration and three-dimensional imaging for the CO₂ Laser Radar Sensor for target identification. Cross-referencing aviation missions to establish C² interface modes and information flow. Complete software development of the Army Digital Avionics System (ADAS) and verify hardware/software baseline, electrically and functionally, via hot bench testing. Award contract for Night Navigation and Pilotage System (NNAPS) Phase 4 Control Panel. Complete Digital Map Generator (DMG) simulation and modify for flight tests. Accept delivery of the Integrated Mission Planning Station (IMPS), a system for preloading flight mission planning data by tape cartridge.

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Program Element: #62202A

Title: Aircraft Avionics Technology

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

FY 1984 — Ruggedize commercial VIA equipment procured in FY 1983 and install in STAR aircraft. Begin development of multicolor samples for a thin-film electroluminescent multicolor display. Prepare specification for nuclear and EMP hardening of Army avionics equipment. Develop architecture for integrated navigation, flight control, and fire control functions. Complete GPS flight test program. Install GPS in Landing Project Aircraft. Continue coordination with the Air Force, Navy, and ERADCOM on programs relating to Air Traffic Management (ATM). Evaluate adverse weather/obscurant system characteristics and performance of vibration signature technique for target detection. Evaluate interface modes and information flow between Army aviation and ACCS. Initiate effort to expand ADAS baseline software to incorporate voice interactive technology, control and display of the Night Navigation and Pilotage System (NNAPS), and absorption of the Integrated Avionics Control System (IACS) control and display functions into the keyboard terminal unit and instrument panel CRTs. Flight test the Digital Map Generator in STAR aircraft supported by the Integrated Mission Planning Station (IMPS) for tape transport cartridge preparation. Integrate IMPS into the Digital Simulation and Integration Facility to support hot bench testing of ADAS and NNAPS.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62208A

Title: Aeronautical Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	16522	22286	25612	28022	Continuing	Not Applicable
AH78	Aeronautical Technology	16522	22286	25612	28022	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: To sustain the operational effectiveness and mission capability of future Army aviation systems integral to the conduct of the land battle, the work performed under this program element is essential to develop and maintain the technology necessary for an Army aviation advantage. The objective of this program is to conduct exploratory development and expand scientific knowledge in the field of aeronautical technology and to exploit this knowledge within the various technical areas/disciplines to: increase operational effectiveness; reduce life-cycle costs; decrease dependence on mechanical components; improve the soldier-machine interface; and improve helicopter analysis, system integration, and flight simulation capabilities, using both in-house and contract research efforts. Technical areas included are: Aeromechanics, Structures, Propulsion, Reliability and Maintainability, Safety and Survivability, Mission Support Equipment, Aircraft Systems Synthesis, Aircraft Subsystems, Advanced Helicopter Analysis, Research and Development (R&D) Flight Simulation, Man-Machine Integration, and Advanced Systems Concepts. These technologies are continuously being developed for application to improve and correct deficiencies in current Army aircraft systems and in the development of future systems such as The Joint Services Vertical Lift Aircraft (JVX) and The Light Helicopter Series (LHX). Requirements are derived from the Science and Technology Objectives Guide (STOG), the Army Aviation Mission Area Analysis (AAMAA), The Air-Land Battle 2000 Concept formulation, and from development of technology opportunities for significant state-of-the-art advancements. Its proposed efforts will be in direct response to existing major Army Technology Base thrusts, specifically that of improving the soldier-machine interface.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	16522	22286	25612	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	18044	24349	27642	Continuing	Not Applicable

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Program Element: #62209A

Title: **Aeronautical Technology**

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

The FY 1982 decrease reflects a reprogramming to higher priority Army programs. The decrease in funding in FY 1983 reflects the results of a Congressional reduction without prejudice. The FY 1984 decreased funding is a result of both program realignment and reprogramming to higher priority Army program requirements as well as revisions of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Related programs are performed by the National Aeronautics and Space Administration — NASA (Low Speed Aircraft Research and Technology — 505-42-XX), Navy (Program Element #62241N — Aircraft Technology), Air Force (Program Element #62201F — Flight Dynamics), and the Federal Aviation Agency (FAA) of the Department of Transportation. Coordination to eliminate unnecessary duplication is accomplished by: joint program reviews, exchange of program data sheets, research and technology resumes, and technical reports; inter-Service liaison; attendance at scientific meetings and conferences; and joint participation in The Technical Cooperation Program (TTCP), NASA Research and Technology Committees, and the North Atlantic Treaty Organization (NATO) Advisory Group on Aerospace Research and Development (AGARD). Efforts under this program lead into Advanced Development under Program Elements #63201A (Aircraft Power Plants and Propulsion), #63711A (Aircraft Electronic Warfare Self-Protection Equipment), #63209A (Air Mobility Support), #63211A (Rotary Wing Controls, Rotors, Structures), and #63220A (Advanced Rotorcraft Technology Integration).

F. (U) WORK PERFORMED BY: The in-house portion of this program is accomplished at the US Army Research and Technology Laboratories, Moffett Field, CA; through the Aeromechanics Laboratory, Moffett Field, CA; Applied Technology Laboratory, Fort Eustis, VA; Structures Laboratory, Langley Research Center, VA; and Propulsion Laboratory, Lewis Research Center, OH. For FY 1984, 54 percent, or approximately \$14 million, of the budget for this program is contracted. The principal contractors currently identified for FY 1984 are Computer Science Corporation, Mountain View, CA; Sikorsky Aircraft, Stratford, CT; Pratt and Whitney Aircraft, LTD, Montreal, Quebec, Canada; Bell Helicopter-Textron, Fort Worth, TX; and Boeing Vertol Company, Philadelphia, PA. At least 20 other contractors will share in this program. Many contracts are still open and will be awarded on a competitive basis.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: **AH78 — Aeronautical Technology**

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Program Element: #62206A

Title: Aeronautical Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

a. (U) Project Description: The purpose of this project is to ensure a vital and sound aeronautical technical base for advanced and engineering development programs leading to Army Aviation Systems improvements in operational effectiveness and combat mission capability; e.g., higher tactical mobility, increased strategic mobility, improved firepower, and increased combat sustainability. This is absolutely necessary so that a helicopter technology edge can be achieved and continually maintained for the United States. Areas of investigation with the technology disciplines previously indicated consist of the following: fluid mechanics, dynamics, flight control technology, acoustics, design criteria, weight prediction, material engineering, internal/external loads, fatigue and fracture mechanics, advanced structural concepts, small air flow gas turbines including thermodynamics and controls, engine accessories, thrust producers, high-temperature materials, mechanical drive systems, diagnostics and prognostics, maintenance and support, survivability through reduced detectability and aircraft and aircrew individual protection, nuclear/biological/chemical/laser protection, flight safety, cargo-handling systems, ground support equipment, secondary power systems, environmental control systems, flight simulation, and aviation human engineering for improved soldier-machine interface. These technologies are being developed for application to all current as well as future Army aircraft systems, including the UH-60A BLACK HAWK Utility Helicopter; the AH-64 Apache Advanced Attack Helicopter; the CH-47 Medium-Lift Helicopter; the AH-1 Cobra Attack Helicopter; The JVX — Joint Vertical Lift Aircraft, and LHX — Future Light Helicopter Series; and preplanned product improvement programs (P3I) of these aviation systems.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Powered-model wind tunnel main rotor/tail interaction test data were analyzed to produce an extensive data base for better understanding of helicopter critical design factors such as tail rotor placement, fin size, and main rotor thrust. A flight test investigation was performed to obtain data giving insight into the cause of loss of directional control of the OH-58 helicopter in certain flight conditions. A neutron radiography unit has been installed which will allow detection of trapped moisture in composite and metallic structures. A full-scale helicopter static/fatigue test facility which will now enable fatigue testing of helicopters of up to 1500 pounds gross weight has been completed. Open-loop testing of an OH-6 with higher harmonic control was initiated. Preliminary data show strong potential for significant vibration reduction. Propulsive high-pressure ratio centrifugal compressor aero and mechanical design was completed, and test hardware procurement initiated. Design and analytical investigation resulting in two different yet compatible design approaches for high-work, single-stage turbines was completed. Computer simulation of a helicopter using adaptive fuel control has been conducted resulting in a unique concept selection and adaptive fuel control preliminary design. An effective Reliability and Maintainability evaluation tool was developed for rotor subsystems and was used to evaluate eight developmental rotors. The feasibility of using shape memory alloys to repair helicopter control tubes and fuel lines was demonstrated. As a result of helicopter oil filter and chip detector improvements, a 1000-hour oil change interval has been recommended for all UH/AH-1 helicopters. Concepts were investigated to provide heat relief to aircrews, reduce potential cockpit contamination, and reduce requirements for large air filters for nuclear/bacterial/chemical operating environments. In support of developing a hover infrared (IR) suppressor for the UH-60 BLACK HAWK, an engine test stand was converted to accommodate a T-700 engine, and a test suppressor was fabricated and successfully tested. A full-scale crash test of an advanced composite aircraft fuselage section was completed with results showing good correlation with the existing simulation model. A joint American-European evaluation of the

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Program Element: #62209A

Title: Aeronautical Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

internal cargo-handling system for the CH-47 was successfully completed. Significant improvements were made to preliminary design methodology for tilt rotors, advancing blade concepts configuration helicopters, and compound helicopters in conjunction with the recent Joint Services Vertical Lift Aircraft — JVX Study Teams. Initial structural analysis and architectural design of the technology portion of the Second-Generation Comprehensive Helicopter Analysis System (2GCHAS) was completed, and a preliminary set of software tools to aid in system development was released to industry. Flight tests of the UH-60 to obtain a data base for simulator validation were completed, and simulation studies related to the XV-15 Tilt Rotor, Rotor Systems Research Aircraft, Advanced Helicopter Improvement Program (AHIP), and UH-1H were performed. A computer graphics task to model information processing and control demands of nap-of-the earth flight was completed using a facility which simulated task demands without visual scene realism. An experimental control-display compatibility test for pilot night vision system symbology was completed. A cockpit workload reduction program was initiated for the Light Family of Helicopters (LHX), including the determination of the feasibility of a one-man cockpit.

(2) (U) FY 1983 Program: The Bearingless Main Rotor (BMR) will undergo limited Phase II testing to expand the forward flight data base for large-scale bearingless rotors. Closed loop testing of higher harmonic control on an OH-6 helicopter to reduce vibration will be completed and improved control laws will be developed. A flight test investigation of various advanced control system configurations will be conducted to provide improved helicopter performance and flying qualities and reduced noise characteristics. Wind tunnel investigations will evaluate torsionally soft articulated rotors, hingeless rotor damping characteristics, hingeless rotor gust analysis methods, and patterns of main rotor/engine gas interaction. Hardware procurement and fabrication for the turbine engine moving sidewall loss investigation will be completed. Combustor improvements will continue with development of a felt-metal/ceramic liner concept to be tested on the reverse-flow rig. Small turboshaft engine research efforts will focus on low-speed stall using a T55-L-712 engine with limited engine distortion, digital electronic control on a T700 engine, and a turbulence study on a T63 engine. Fabrication of corrosion-resistant bearings with improved fracture toughness and tapered roller bearings designed for oil-off survivability will be completed. Work will continue on superhard transparent coatings for helicopter canopies by establishing a final coating formulation and developing manufacturing techniques for application. An effort will be initiated to develop cannibalization procedures to identify serviceable components and structures of battle and crash-damaged helicopters and to quickly remove these components and structures from the helicopter. Testing of the hover infrared (IR) suppressor for the UH-60 will be completed. Testing of various helicopters to NBC, EMP, and laser threats will continue, and techniques to counter these threats will continue to be investigated. Complete analysis and documentation of the composite fuselage crash test will be completed. Hardware fabrication and evaluation testing of an external cargo load snubbing system will be completed. Application and materials compatibility testing of the self-limiting active solvent hyperchloride decontamination agent will be completed. A plan for developing in-house computer graphics and computer-aided design (CAD) capability for preliminary design of advanced concepts will be completed. Parameter definition, preliminary design, and detailed design of an advanced icing severity level indication system will be completed. Flight tests to quantify the effects of blade icing on hover performance will be completed. A Request for Proposals (RFP) for the development of technology modules for the Second-Generation Comprehensive Helicopter Analysis System will be issued, and the first build of the Executive Complex of the system will be completed. Processing and correlation of UH-60 flight test data with the current simulation math model will be completed. Validation of ground-based simulation with actual UH-60 BLACK HAWK data will be initiated. Evaluation of the compatibility of displays with multiads integrated controllers will be conducted, and flight simulation to

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Program Element: #62208A

Title: Aeronautical Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

evaluate the pilot's use of peripheral vision as a requirement for simulator design will be performed. Simulation studies will investigate nonvisual communication for transfer of information related to navigation and tactics as well as flight critical status. The Light Helicopter Series (LHX) predesign studies will be completed providing configuration data, weapons systems, evaluation, and single-pilot cockpit capability evaluation.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Analysis of the results of previous wind tunnel tests of main rotor/exhaust gas interactions will be conducted focusing on development of design guidelines for avoidance of reingestion phenomena. Planned tests include main rotor/fuselage/tail rotor aerodynamic interactions. Results of thrust response simulation studies will be coalesced with engine control technology to develop engine fuel control compensation techniques to insure adequate handling qualities for nap-of-the-earth helicopter operations. Internal noise source measurements will be used to validate analytical models and source/path identification methods, and a program to develop prediction techniques for noise transmission through composite structures will be initiated. Flight tests of various rotor mast heights will be completed to provide an understanding of the nature of rotor/airframe interactions and provide design guidelines for avoiding interaction problems. An investigation of rotor design loads incurred during helicopter air-to-air combat maneuvers will be initiated to develop new design loads criteria. Improved design criteria for damage tolerance and durability of composite helicopter structures will be developed. Bench tests will be conducted on an engine adaptive fuel control system. Tests of a moving sidewall stator for turbines will be completed, and fabrication and evaluation of a pivoting vane configuration will be initiated. Fabrication of a 3000-horsepower (HP) hybrid transmission and a 500-HP transmission will continue. Small turboshaft engine efforts will include completion of low-speed stall research on the T55 and completion of the digital electronic control program using the T700. Fatigue tests of bearings with corrosion-resistant material and improved fracture toughness will be completed. A rotor system reliability and maintainability design guide and an advanced structures design and repair guide will be completed. A study to develop structures inspection and repair concepts for helicopter battle damage will be completed. UH-60 BLACK HAWK infrared (IR) suppressor thermal cycle and endurance testing will be completed. An integrated modular dual spectrum fire detection-suppressor sensor will be fabricated and tested. Hardware fabrication and laboratory testing for a low-visibility advanced external load acquisition system will be completed. Initial computer-aided design (CAD) capability for in-house preliminary design activities will be made operational. Fabrication of an advanced icing severity level indication system will be completed and flight test initiated. Actuator design in support of advanced rotor actuation concepts will be completed. System integration and first-level release of Second-Generation Comprehensive Helicopter Analysis System will be accomplished. A study will be initiated to establish the feasibility of incorporating head-directed, area-of-interest scenes in the Rotorcraft Systems Integration Simulator. Studies of information transfer capabilities of voice technology will continue aimed at the possibility of single-pilot helicopter systems. System trade-offs in support of the Light Helicopter Series (LHX) requirements definition will continue as the Air-Land Battle 2000 concept evolves.

(4) (U) Program to Completion: This is a continuing program.

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Program Element: #62209A

Title: Aeronautical Technology

DOD Mission Area: #623 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62210A

Title: Airdrop Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1415	1684	2038	2170	Continuing	Not Applicable
D283	Airdrop Technology	1415	1684	2038	2170	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element supports basic airdrop technology. The technological output is critical in fielding new airdrop systems and equipment that provide and upgrade the US capability to employ and resupply Airborne and conventional combat units. Both the High Technology Light Division and Air-Land Battle 2000 concepts rely heavily on the use of airdrop for resupply of forces far forward. The goals of the technology are identification of concepts/means to improve strategic airlift and to solve the deficiencies of inadequate airdrop survivability, inaccurate airdrop insertion, and inability to drop large fire and combat support material. New airdrop concepts are evaluated which have a potential for increasing mission capabilities of airdrop/airlift operations and for reducing the costs of acquisition, use, and logistics support of airdrop systems and equipment. Eight efforts comprise the Airdrop Technology project which supports all of the military services and is the basis for the two related airdrop projects in advanced and engineering development.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	1415	1684	2038	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	1540	1688	2144	Continuing	Not Applicable

Reduction of \$125 thousand in the FY 1982 funding level is the result of reprogramming to higher priority Army requirements. The funding decrease of \$4 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. The decrease of \$106 thousand in FY 1984 resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #62210A

Title: Airdrop Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Program Elements #63218A (Airdrop Equipment and Techniques) and #64218A (Airdrop Equipment Development); Joint Technical Airdrop Group; North Atlantic Treaty Organization, and Air Standardization Coordinating Committee (ASCC/WP44); Mutual Weapons Data Exchange Agreements with France, Germany, and Korea; and United States/Germany nonmajor items meetings. International and inter-Service agreements and boards are used to exchange information on gains in airdrop technology, to avoid duplication of effort through joint and combined efforts, and to promote and attain the objectives of US Rationalization, Standardization, and Interoperability (RSI) policies and programs.

F. (U) WORK PERFORMED BY: AAI Corporation, Baltimore, MD; Pioneer Parachute Company, Manchester, CT; US Army Yuma Proving Ground, AZ; US Army Natick Research and Development Laboratories, Natick, MA; Sandia National Laboratories, Albuquerque, NM; MAAKO Enterprises, Los Angeles, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D283 — Airdrop Technology: The specific objectives of the project are: increase airdrop operational capabilities at all altitudes, at higher air speeds, and in all weather and geographical environments in order to improve strategic airlift capabilities; increase airdrop accuracy; reduce drop-zone dispersion; provide the technology base for advanced airdrop systems; eliminate technical barriers hindering attainment of new airdrop capabilities; and reduce the costs of developing and maintaining airdrop components and systems. FY 1982 accomplishments: The Stag Wing and V-Cell gliding canopies have been fabricated and test flown successfully. Fabrication of a prototype Airdrop Guidance System including an airborne guidance computer, sensors, and servo module has been completed. Development of the guidance software for this system continues, and guidance calculations are being refined by use of the guidance simulation code. Work to determine the fragility in terms of the maximum allowable impact velocities and acceleration for the seven vehicles most frequently airdropped has been initiated. A technical report describing the results of the investigation of the balloon-skirt airbag has been published. A survey of mechanical energy-absorbing devices for soft landing application was started as was the preliminary design of a retro-rocket airdrop system. The development of concepts to provide drive-on, drive-off capability for heavy airdrop loads and a systems analysis of current rigging techniques was initiated. A concept to induce a controlled roll in the high-level airdrop system has been selected. This concept which minimizes lateral drift has been incorporated in the design of 3/8-scale-model platform systems and drop tests have demonstrated the feasibility of the concept. The feasibility of low-level personnel parachutes has been demonstrated. A study was begun to design a free-fall water container. An experimental program to investigate the scaling laws of parachutes has been formulated, and fabrication of 3/4-, 1/2-, and 1/4-scale models of the C-9 parachute to be used in drop test has been initiated. An investigation of the effect of static electric charges generated through parachute deployment on the opening of parachutes and on electrically fused weapons by such charges was initiated. The wind tunnel tests to determine the character of the airflow behind Air Force Cargo Aircraft and to measure the behavior of extraction parachutes in the aircraft wake were completed, and the test results are being analyzed. FY 1983 Program: For small gliding canopies, complete flight tests and assembly of guidance software. Initiate flight tests of large canopies (300 square meters). Complete studies of fragility criteria for vehicles and test design refinements of the airbag cushion system. Initiate a breadboard retro-rocket, soft landing system. Complete the analysis of

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Program Element: #62210A

Title: Airdrop Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

current rigging techniques, and initiate new concepts needed for achieving a drive-on, drive-off capability. Complete testing and evaluate the results of 3/8-scale-model, high-level platform airdrop system. Complete the exploratory work on a free-fall water container and investigations into the effects of static electric generated during parachute deployment. Determine the relationship between aircraft wake structures and behavior of extraction parachutes. Reinitiate exploratory development of high-speed airdrop technology. FY 1984 Program: Continue flight tests of large-canopy gliders together with guidance and control systems. Review alternate approaches to soft landing to include retro-rocket application. Transfer selected concepts of soft landing, new rigging, and high-level platform technology to advanced development. Initiate investigation of concepts for high-level airdrop of personnel and airdrop capabilities needed in support of Air-Land Battle 2000 doctrine. This is a continuing technological program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62303A

Title: Missile Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	28793	32558	34962	36141	Continuing	Not Applicable
A214	Missile Technology	28793	32558	34962	36141	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is the Army exploratory development work for improvement in fielded Army missile and rocket components and technical options for use in future tactical missile systems in response to US Army Training and Doctrine Command Mission Area Analyses of Deficiencies. These deficiencies are addressed through work in applied research, laboratory hardware development, and limited technology demonstrations in the areas of close combat, fire control, and air defense. This program is needed to achieve and protect technological leads in tactical missile and rocket technology while providing the Army a critical capability to: (1) acquire the best missile/rocket systems at the least life cycle costs; (2) provide technological advancement in areas where there is little or no industry incentive due to lack of commercial applications; (3) provide a quick-response capability in time of crisis; and (4) preclude technological surprises by potential enemies. Efforts in this program are focused on technologies that will enhance the capabilities of missiles to operate effectively in adverse battlefield environments, improve the survivability of missile and rocket launch platforms, make our systems more effective against hard targets, provide affordable but necessary sophistication to overcome enemy numerical advantages, and provide near-term insertion in fielded and developing systems.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	28793	32558	34962	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	30041	37651	37575	Continuing	Not Applicable

The funding decrease of \$1248 in FY 1982 is a result of reprogramming to a higher priority requirement. The decrease of \$5093 thousand in FY 1983 is a result of a \$5000 thousand reduction at Congressional direction in the FY 1983 Appropriations Act and a \$93 thousand reduction from pro rata application of general Congressional reductions to the RDTE, A appropriation. The decrease of \$2613 thousand in FY 1984 is a result of adjustments

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Program Element: #62303A

Title: Missile Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

to the technology base in support of the New Technology Thrust effort and from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Efforts in this program relate closely to science and technology programs conducted by the Defense Advanced Research Projects Agency (PE #62711E, Tactical Technology), the US Navy (PE #62332N, Strike Warfare Weaponry Technology), the US Air Force (PE #62602F, Conventional Munitions, and 63601F, Conventional Weapons), and the Army (PE #63306A, Terminally Guided Projectiles). Duplication is precluded by active participation by laboratory personnel in interagency working groups and deliberate structuring of the program to concentrate on the Army's unique need in tactical missiles. Where areas of potential unwarranted duplication or opportunities for cooperation have been identified, appropriate agreements have been effected with the command/agency concerned. Membership exists in working groups of the Joint Services Guidance and Control Committee, The Joint (tri-Service) Technical Coordinating Group for Munitions Development (Missiles and Rockets), the Joint Army/Navy/NASA/Air Force Propulsion Committee, and North Atlantic Treaty Organization Panels.

F. (U) WORK PERFORMED BY: The US Army Missile Command, Redstone Arsenal, AL, has primary responsibility for execution of this program. Approximately 50 percent of the dollars are contracted out to more than 58 companies and universities. The top five contractors include Computer Sciences Corporation, Huntsville, AL; Sperry Support Services, Huntsville, AL; The Boeing Company, Seattle, WA; Ford Aerospace/Aeronutronic Division, Newport Beach, CA; and Martin Marietta Corporation, Orlando, FL. Approximately \$9 million is contracted out with 53 other contractors.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: A214 — Missile Technology

a. (U) Project Description: This program provides for the integration of domestic and foreign technological innovations and advancements into Army missile and rocket components. Principal products under investigation emphasize technology that permits autonomous acquisition of targets, cost reduction techniques, missile operation in adverse natural and artificial environments, survivability enhancements, man-weapon interoperability improvements, and the exploitation of technological opportunities which may counter new threats and improve the force multiplier ratio of Army combat forces. Over 50 percent of the program is in direct support of the Self-Contained Munitions thrust, one of five new Army technology thrusts. The broad objectives of the program are to: (1) develop guidance and control and terminal homing systems having multimode and autonomous target

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Program Element: #62303A

Title: Missile Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

acquisition capabilities, reduced vulnerability to antiradiation missiles, and the capability for operation in adverse weather and countermeasures environment; (2) develop minimum signature propulsion systems and low-cost missile/rocket components with improved service life; (3) reduce development costs through simulation; and (4) reduce risk in new system development. These objectives involve most of the scientific and engineering disciplines related to missile and rocket development. The program consists of nine technology areas with work areas described as follows: Sensors — radio frequency guidance; autonomous target acquisition; millimeter wave and laser guidance; beamrider guidance; infrared homing, sensor design, and signal processing; digital beam forming for advanced air defense radars; and terminal homing measurements. Guidance — automatic multitarget correlation handoff; inertial guidance components and systems; control systems; and missile tactical software. Simulation — radio frequency simulation technology; infrared/electro-optical simulation technology; multimode simulation technology; and millimeter simulation. Technology Integration — integration of technologies for demonstration of air defense, close combat, and field artillery missile and rocket concepts. Aerodynamics — advanced missile interceptor aeroballistics; tactical missile aeropropulsion technology; submissile aerodynamics; and advanced rocket aerodynamics. Propulsion — minimum signature propulsion; quantification of propulsion signature impact; next generation of propellants; prediction/extension of useful life of propellants; and air-breathing propulsion. Structures — structures methodology; advanced materials applications and fiber composite structures; and launcher/loader and ground support equipment improvements. Technology Planning — conduct overall planning and management of program element to include utilization and evaluation of industrial independent research and development. Applications and Analysis — generate concepts for affordable future missile systems which can defeat the evolving threat.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Preparatory to an advanced development project in FY 1983, completed exploratory development on a fiber optics guided missile concept which permits firing from full defilade, controlled from a man-in-the-loop gunner's station, and having a seeker to home on designated armor targets; completed exploratory development on a millimeter wave seeker for terminally guided submissiles to attack armor targets in adverse environments; completed exploratory development on a fly-over, top-attack antiarmor missile concept which uses a light-weight sensor and defeats armor targets with a self-forging-fragment warhead; completed exploratory development on a carbon dioxide laser beamrider concept which has the potential to accurately guide a hypervelocity missile; completed the baseline airframe for a 2.75-inch kinetic energy, antiarmor rocket launched from a helicopter; and conducted the initial demonstrations of an air defense track-while-scan quiet radar.

(2) (U) FY 1983 Program: Complete demonstration of an air defense, ultra low sidelobe, quiet radar in a realistic hostile environment (to enter non systems advanced development in FY 1984); complete tests on options for an automatic acquisition, low-cost imaging seeker; complete exploratory development on a minimum signature rocket motor for a potential product improvement to STINGER; complete demonstration of means to reduce the noise level to the missile gunner and launch vicinity of close combat weapons; complete accuracy tests on a separating penetrator, kinetic energy, antiarmor rocket fired from a helicopter in simulated flight; complete demonstration of a passive infrared guidance scheme integrated with an

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Program Element: #62303A

Title: Missile Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

existing radio frequency homing interceptor to provide less sensitivity to electronic countermeasures; and complete demonstration of a dynamically aimed, light artillery rocket system having potential application to the Rapid Deployment Force.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Complete demonstration of a fire-and-forget, multienvironment active radio frequency seeker which can be used against stationary or moving armor targets; complete studies on an imaging infrared seeker which is entering advanced development for close combat application; complete performance design studies to develop lock-on-before-launch and lock-on-after-launch alternatives for adverse environment millimeter and radio frequency seekers; adapt Navy/Air Force Medium-Range Air-to-Air Missile (AMRAAM) seeker design for potential Army air defense application; complete development of an aerodynamics data bank and analytical method to predict submissile interaction; complete feasibility demonstration of a dual-thrust, minimum rocket motor for short-range air defense; complete hypervelocity launch technology for helicopter application; complete demonstration of a multisensor air defense acquisition system which combines a quiet radar with an infrared detection and acquisition system; complete demonstration of on-board processing capabilities for an air defense system/seeker which will show significant improvement against a wide range of countermeasures; complete demonstration of optical correlator target cueing for application to a fiber optics guidance system; and begin demonstration of hypervelocity flechette dispersal techniques for a low-cost application to helicopter self-protection.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62307A

Title: Laser Weapons Technology

DOD Mission Area: #524 — Directed Energy Technology
(ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	23295	41881	32839	36284	Continuing	Not Applicable
A139	Laser Weapons Technology	23295	41881	32839	36284	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides the exploratory development high-energy laser technology base for potential Army mission applications in the close combat and air defense mission areas through advancements in laser devices and components, acquisition and fire control, beam control and optics, and the damage and effects data base. This program also provides the definition and analysis of laser weapons concepts and risk reduction in support of laser weapon demonstrator and verification efforts. Near-term emphasis is the ROADRUNNER demonstration of the ability to defeat in a realistic environment by the use of lasers that are of the targets. Longer term technology tasks are aimed at achieving more capable laser weapons. Army forward area ground forces need the capability to defeat enemy weapons of the electromagnetic spectrum. Potential enemy forces use and rely upon such. Our possession of this capability will deny to enemy forces the ability to on the battlefield. This capability will provide a critical force multiplier and increase the survivability of Army ground forces.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	23295	41881	32839	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	22926	31327	34086	Continuing	Not Applicable

The funding increase of \$369 thousand in FY 1982 is a result of reprogramming for advanced aerosols propagation testing and a technology effort for composite lightweight high-pressure gas bottles. The funding increase of \$10554 thousand is a result of Congressional direction in the FY 1983 Appropriations Act and pro rata application of general Congressional reductions to the RDTE, A appropriation. The funding decrease of \$1257 thousand in FY 1984 is a result of revision or the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #62307A

Title: Laser Weapons Technology

DOD Mission Area: #524 — Directed Energy Technology
(ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable

E. (U) RELATED ACTIVITIES: All DOD high-energy laser programs are closely coordinated by the Office of the Under Secretary of Defense for Research and Engineering to insure maximum benefit to the DOD and to preclude duplication of effort. The Navy is developing high-energy laser technology in Program Element #62735N (High-Energy Laser Technology), and Program Element #62768N (Directed Energy). The Air Force is carrying out high-energy laser development efforts in Program Element #63605F (Advanced Radiation Technology) and Program Element #62601F (Advanced Weapons). The Defense Advanced Research Projects Agency is supporting development of advanced lasers, optics, and pointer-tracker for space applications in Program Element #62711E (Experimental Evaluation of Major Innovative Technologies) and Program Element #62301E (Strategic Technology). The DOD is establishing a National High Energy Laser test capability in Program Element #65806A (High Energy Laser System Test Facility).

F. (U) WORK PERFORMED BY: The top five contractors are: Westinghouse Systems Development Division, Baltimore, MD; TRW Defense and Space Systems Group, Redondo Beach, CA; Hughes Aircraft Company, EL Segundo, CA; AVCO Everett Research Laboratories, Everett, MA; and United Technologies Center, East Hartford, CT. There are approximately 80 additional contracts and an estimated total contract value of \$40 million in FY 1983. The US Army Missile Command, Redstone Arsenal, AL, is the in-house developing organization.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: A139 — Laser Weapons Technology

a. (U) Project Description: This program provides for the development of the high-energy laser technology base for future laser weapon system developments, the formulation of laser weapon system concepts for viable Army missions, the demonstration of the capabilities of laser systems, and the exploration of the possible utility of other directed energy technologies such as particle beam and electromagnetic pulse. The program consists of eight technological work areas: Chemical Lasers — advanced nozzles; advanced chemical pumps; solid fuels, oxidizers, and diluents; and repetitively pulsed chemical lasers. Electric Lasers — pulsed lasers employing ultraviolet, X-ray, and cold cathode electron beam preionization schemes, and ancillary subsystem hardware including lightweight electrical power generation and power conditioning equipment. Optics — closed-loop mirror figuring; output windows; composite mirrors; optical coatings; and optical component protection. Beam Control/Propagation — hot-spot tracking; integrated pointer-tracker design; beam control system simulation; precision imaging tracker; propagation cell/smoke experiments; repetitively pulsed beam diagnostics; and propagation field tests. Acquisition/Fire Control — improved acquisition techniques; new radar design; fire control

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Program Element: #62307A

Title: Laser Weapons Technology

DOD Mission Area: #524 — Directed Energy Technology
(ED)

Budget Activity: #1 — Technology Base

simulator; target identification and damage assessment techniques; and fire control system design. Damage and Vulnerability — establishment and analysis of laser damage mechanisms and damage thresholds for Concepts and Mission Analysis — laser weapon system concept definition, concept development, fieldability, operational effectiveness, and cost analysis for close combat and tactical air defense missions. Advanced Laser Techniques — development of new or advanced lasers, components, and techniques to advance the state-of-technology, involving development of agile wavelength lasers, multilaser combination, efficient excitation techniques, and evaluation and exploitation of evolving laser devices and techniques.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Successfully demonstrated the scalability of the calcium-based chemical pump for an Army weapon-size chemical laser. Demonstrated the feasibility of a more efficient, less complex, and less expensive lithium chemical pump approach. Demonstrated ultraviolet preionized pulsed carbon dioxide electric laser output energies of greater than from gases suitable for battlefield use. Initiated a joint program with the Air Force Materials Laboratory for laser output material window development. Completed the joint Army/Navy Hot Spot Tracking Program using chemical lasers. Completed the fabrication of the Advanced Baseboard Tracker, and integrated it into the Hot Spot Tracking demonstration. A 10-meter propagation cell was installed at Redstone Arsenal, and in-house propagation experiments were conducted through typical battlefield aerosols and smokes with the repetitively pulsed carbon dioxide laser device. Experimentally validated damage assessment techniques using target signature reduction. Initiated competing fire control system designs. The damage and vulnerability data base was expanded through tests on a variety of US and foreign optical and sensor targets using the currently available laser wavelengths and waveforms. The preliminary design phase of the ROADRUNNER demonstrator was completed and the detailed design phase initiated. The Forward Area Laser Weapon-Demonstrator program was terminated at Congressional direction after completion of the preliminary design phase.

(2) (U) FY 1983 Program:

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request:

(4) (U) Program to Completion: This is a continuing program.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62801A

Title: Tank and Automotive Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	17437	16952	24662	22849	Continuing	Not Applicable
AH81	Tank and Automotive Technology	17437	16952	24662	22849	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of this program is: (1) To advance the state-of-the-art of tank and automotive technology allowing for the development of Combat and Tactical Vehicle systems that can defeat the anticipated threat on the future battlefield; (2) to conduct product line planning and develop technology to improve the cost and combat effectiveness of tank-automotive systems; (3) to improve mobility through the development of improved engine, transmission, and supporting tank-automotive components; (4) to conceive and develop total vehicle system concepts to meet the user's Division 86 midterm requirements, the Air-Land Battle 2000 far-term requirements, and the High-Technology Light Division needs; and (5) to enhance vehicle survivability against current and anticipated threats through the integration of vehicle design, active and passive countermeasures, ammunition compartmenting, and composite materials.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	17437	16952	24662	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	14648	19925	26500	Continuing	Not Applicable

The funding increase in FY 1982 of \$2.789 million is a result of reprogramming to provide for the early start of the armor integration task to identify and exploit new armor materials and protection technology for combat vehicle application to improve vehicle survivability against high-energy antitank (HEAT) warheads and kinetic energy (KE) penetrators. The funding decrease of \$2.973 million in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act. The FY 1984 decrease of \$1.838 million is the result of an Army decision to fund efforts on a series of new technology base thrusts and revision of the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #62801A

Title: Tank and Automotive Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Specific program elements related to the technical areas of this program element are: PE #61102A (Defense Research Sciences); PE #62105A (Materials); PE #62803A (Large Caliber and Nuclear Technology); PE #62733A (Mobility Equipment Technology); PE #62618A (Ballistics Technology); PE #63102A (Materials Scale-Up); PE #63201A (Aircraft Power Plants and Propulsion); PE #63608A (Tank Gun Ammunition); PE #63621A (Combat Vehicle Propulsion Systems); PE #63631A (Combat Vehicle Turret and Chassis); PE #63602A (Advanced Land Mobility Systems Concepts); and PE #23735A (Combat Vehicle Improvement Program). A close relationship is maintained with other Services and Government agencies through regular conferences and coordination meetings to preclude duplication of effort. Research and development information concerning respective allies' tank-automotive technology is being shared via data exchange agreements. A new management concept was initiated in 1982 to create Technology Area Managers to concentrate on national efforts in a particular technology and thus uncover any unnecessary duplication of effort.

F. (U) WORK PERFORMED BY: US Army Tank-Automotive Command, Warren, MI, has the responsibility for the implementation of this program. Other Army in-house organizations that support this program are: US Army Armament Research and Development Command, Dover, NJ; US Army Missile Command, Huntsville, AL; US Army Electronics Research and Development Command, Adelphi, MD; US Army Natick Research and Development Laboratories, Natick, MA; US Army Test and Evaluation Command, Aberdeen, MD; Waterways Experiment Station, Vicksburg, MS; the Human Engineering Laboratory, Aberdeen, MD; Naval Research Laboratory, Washington, DC; and Cold Regions Research and Engineering Laboratory, Hanover, NH. Major contractors participating in the program are: Stevens Institute of Technology, Hoboken, NJ; Food Machinery Corp, San Jose, CA; General Dynamics Corp, Warren, MI; Teledyne Continental Motors Corp, Muskegon, MI; Pacific Car and Foundry Co, PACCAR, Renton, WA; Garrett Corp, Phoenix, AZ; Wiley Laboratories, El Segundo, CA; Georgia Tech, Atlanta, GA; Optimetrics Inc, Ann Arbor, MI; Keweenaw Research Center, Houghton, MI; Environmental Research Institute, Ann Arbor, MI; Battelle Laboratory, Columbus, OH; and Williams International Inc., Walled Lake, MI.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: AH91 — Tank and Automotive Technology

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Program Element: #62601A

Title: Tank and Automotive Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

a. (U) **Project Description:** This project provides funds to advance the state-of-the-art in tank and automotive technology, leading to the development of ground combat, combat support, and tactical vehicle systems and componentry that will improve the Army's ability to fight the anticipated threat. The program is divided into four areas: mobility, systems integration, survivability, and vetronics. The mobility effort provides for exploratory development of improved propulsion systems, track and suspension systems, structures/chassis, and components/materials. The systems integration effort provides for the development of advanced concepts for future close combat, combat support and tactical vehicle systems. The result of this integration is a base of subsystem options through innovative subsystem integration techniques. These techniques will provide combat vehicle ammunition compartment integration to reduce damage caused by exploding ammunition; development of combat vehicle analysis methodologies for optimizing total vehicle systems designs; and examination of new techniques to assist the designer in creating an optimized design. The vetronics objective is to develop a system architecture and standard for more efficient integration of vehicle electrical/electronic systems and realtime integration with the electronic battlefield. The survivability thrust area is directed toward providing the technology, components, and techniques which minimize combat vehicle susceptibility to detection and identification as a target and the reduction of the probability of being hit. The effort combines the tasks in technologies such as countermeasures, ammunition compartmenting, fire suppression, armor, and vehicle application of robotics into concepts that exhibit potential improved military effectiveness.

b. (U) **Program Accomplishments and Future Efforts:**

(1) (U) **FY 1982 Accomplishments:** The Future Close Combat Vehicle Systems (FCCVS) Phase I concept studies, concentrating on the 1990-2000 timeframe, have been completed. The vehicle concepts developed utilize technologies possible for a 1995 fielding date. In-house conceptual studies were performed for the light air defense system, Improved Conventional Weapon System (ICAS) vehicles, M551 alternative vehicle concepts; Advanced IFV variants and Light Armored Vehicle (LAV) variants. A new approach to development of a highly survivable lightweight combat vehicle was initiated focusing design of an Integrated Countermeasures Combat Vehicle on solutions other than passive armor such as vehicle signature reduction, threat warning, and reaction techniques. Advanced Adiabatic Technology — Low-friction bearings were designed and fabricated with rig testing initiated. Initial analysis, design fabrication, and rig testing of piston/linear combinations were performed. Solid lubricated advanced camshaft/valve train design was completed. Vetronics — The science and technology of electronics applied to vehicles was initiated. Purchase order contracts were awarded to 14 avionic/electrical/vehicle companies to stimulate their Independent Research and Development (IR&D). Track Technology — Track rubber analysis identified degradation products. Improved formulation and ingredient dispersion resulted in a 50% increase in blowout resistance. Advanced Turbine Components — Final work prior to demonstrating the zirconium oxide-coated turbine wheel was completed.

(2) (U) **FY 1983 Program:** The second phase of the Future Close Combat Vehicle System (FCCVS) concept studies focusing on higher risk/higher payoff technologies targeted for the post-year 2000 timeframe will be completed. New ammunition compartment design techniques for use with autoloaders will be developed. Integrated Countermeasure Vehicle Concepts employing missiles and advanced subsystems will be developed. Advanced Adiabatic Technology — Conduct single-cylinder engine demonstration using low-friction, ceramic bearings. Demonstrate single-cylinder

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Program Element: #62601A

Title: Tank and Automotive Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

engine operation without oil. Conduct initial multicylinder tests without engine oil. Vetronics: Initiate development of system architecture standards and identify subsystem interface requirements. Begin power source distribution study. Track Technology — Continue track rubber development effort to establish dispersion standards, improve heat conduction, develop nondestructive test methods for quality assurance and study property structure relationships to support improved polymer synthesis. Initiate and complete design of an Advanced Suspension System with pneumatic springing and hydraulic damping and start fabrication of one laboratory test unit. Brassboard ionization dust detector will be fabricated and installed on an M60 tank at Fort Knox, KY, to determine vehicle compatibility.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Complete the concept formulation of the Infantry Fighting Vehicle (IFV) testbed design. Support user requirements definition of the Command, Control, Communications (C³) Vehicle. Analyses of the Future Close Combat Vehicle contracts will lead to consonance with TRADOC to defining required subsystem and system performance criteria for advanced combat vehicles. Complete advanced Adiabatic Technology variable valve and porting/manifold design. Demonstrate oilless engine operation and minimum friction concept on a multicylinder engine. Develop vetronics system architecture standard and subsystem interface standard. Develop a standard power source distribution system. Transition ATEPS, Advanced Diagnostics and Advanced Prognostics programs to vetronics. Complete fabrication of an advanced suspension with pneumatic springing and hydraulic damping, and conduct performance evaluation in the laboratory followed by starting fabrication of a vehicle set. Produce advanced turbine components and prototype hardware for high-temperature recuperator and high-pressure rotating regenerator.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62803A

Title: Large Caliber and Nuclear Armaments Technology

DOD Mission Area: #523 -- Engineering Technology (ED)

Budget Activity: #1 -- Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	22652	16793			Continuing	Not Applicable
AH18	Large Caliber & Nuclear Armaments Technology	22652	16793			Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Large Caliber and Nuclear Armaments Technology program performs exploratory systems development and necessary supporting research to further the state-of-the-art in weapons, munitions, and their interfaces. The output of this program is used in defining promising revolutionary systems as well as product improvements associated with evolutionary development. The project supports the Close Combat Heavy Mission Area through the development of an Improved Conventional Armament System (ICAS), Armament Systems for Light Armored Vehicles (ASLAV), and Tank Smart Munitions (TSM). The Fire Support Mission Area is addressed by development of an Integrated Smart Artillery System (ISAS) and a Conventional Geometry Smart Projectile (CGSP), and Safing, Arming, and Fuzing (SAF) for the Corps Support Weapon System (CSWS). The Air Defense Mission Area is supported by SAF for SENTRY (Low Altitude Air Defense System) and exploratory development of active/passive electronic counter-countermeasures. Ongoing high-technology tasks in this project support multiple mission areas: Smart Munitions Component Technology (millimeter wave and infrared sensors); long-standoff warheads and search, point, and fire mechanisms; energetic materials (explosives, propellants, and pyrotechnics); weapons, munitions, weapon/munition interface; nuclear technology; and fuze technology. These efforts form the foundation for subsequent weapon and munition advanced developments, engineering developments, and many product improvement programs. A fundamental commitment has been made to address requirements and priorities as defined by the user, with concentration of effort and resources on those objectives having the highest priority and highest potential payoff. Technology efforts within this project are consistent with overall consolidated guidance by Department of the Army and support new Army thrusts in the areas of self-contained munitions, soldier/machine interface, and target acquisition systems.

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Program Element: #62603A

Title: Large Caliber and Nuclear Armaments Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	22652	16793		Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	19750	20054		Continuing	Not Applicable

The increase in FY 1982 funding resulted from the required Army support of continuing armor/antiarmor efforts for ground combat vehicles capable of defeating advanced shaped charge and kinetic energy armor threats. A funding decrease of \$1210 thousand in FY 1983 is a result of reprogramming of funds for High Technology Light Division and reflects the reprogramming of funds to higher priority Army projects. The remaining FY 1983 decrease resulted from Congressional reductions in the FY 1983 Appropriations Act and pro rata application of general Congressional reductions to the RDTE, A appropriation. The decrease of \$16996 thousand in FY 1984 reflects the reprogramming of funds to higher priority Army projects.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Technical Areas of this program are related to Program Element #62617A (Small Caliber and Fire Control Technology), #62618A (Ballistics Technology), and numerous advanced and engineering development projects. Coordination of similar efforts conducted by the Air Force and Navy is accomplished by visits of technical personnel, interagency meetings, and tri-Service reviews and workshops to encourage cross-fertilization and preclude duplication.

F. (U) WORK PERFORMED BY: In-house efforts are conducted at the US Army Armament Research and Development Command facilities located at Dover, NJ, Aberdeen, MD, and Edgewood, MD. Contract support is provided by Motorola Government Electronics Division, Scottsdale, AZ; Florida University, Gainesville, FL; Honeywell, Minneapolis, MN; Norden Systems, Norwalk, CT; Firestone Tire & Rubber, Akron, OH; Westinghouse Electric Corporation, Pittsburgh, PA; Martin-Marietta, Orlando, FL; Raytheon, Bedford, MA; General Electric, Burlington, VT; MIT, Boston, MA; Aerojet Electric Systems Corp, Azusa, CA; and numerous other small contractors.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

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Program Element: #62603A

Title: Large Caliber and Nuclear Armaments Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: AH16 — Large Caliber and Nuclear Armaments Technology

a. (U) **Project Description:** The Army has a critical need to provide more effective tank firepower systems to defeat projected threats in the 1990s and year 2000. Critical tasks will provide antiarmor munitions to defeat projected threats and technology that can lead to lighter weight and smaller tank firepower systems. In the Fire Support area, the Army has critical needs to provide direct support systems that are more responsive, have higher firing rates, reduced labor intensity, and great firepower against armored targets. Key tasks will evaluate robotic technology for self-propelled howitzers and provide critical experiments on munitions that are easier to handle and have improved antiarmor capability. In the high-technology area the Army has critical needs to develop munitions and launch technologies that can provide major increases in firepower and system effectiveness. Key tasks will be pursued to provide energetic materials that can lead to superenergetic explosives for warheads with improved armor penetration. In addition integrated tasks for primers and fuzes will provide a technology base for projectiles to meet threats and requirements for the post-1990 timeframe and for Air-Land Battle 2000. Also in order to meet Army needs for higher muzzle velocities and higher performance, key technology tasks will be pursued for new solid propulsion techniques and electromagnetic propulsion systems.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments:

a. (U) **Close Combat Heavy:** The optimum Improved Conventional Armament System (ICAS) configuration was established. ICAS is responsive to Air-Land Battle 2000 in that it is tailored to the NBC environment, will have a highly lethal direct fire armament system and autoloading capability. Rocket-Assisted Kinetic Energy (RAKE) prototype rounds were successfully fired during FY 1982. RAKE is designed to provide the lethality of large caliber guns and kinetic energy warheads to light armored vehicles.

b. (U) **Fire Support:** A 155mm projectile, utilizing terminal homing technology developed under this project, will provide increased accuracy and lethality against moving armored targets. Howitzer Test Bed (HTB) III was tested in the Human Engineering Laboratory Battalion Artillery Test (HELBAT) VIII and demonstrated major increases in accuracy; improved soldier/machine automation; compatibility with advanced decentralized command, control, communications, and intelligence technology; and ability to perform hip-shoot missions with significant reduction in time (< 1 min vs 15-20 min).

c. (U) **High Technology:** Westinghouse tests of a rail electromagnetic accelerator exceeded muzzle velocity goals and provided a basis for optimism that the technology can be weaponized. The Westinghouse test fixture was shipped to the Dover site and installed during FY 1982.

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Program Element: #62603A

Title: Large Caliber and Nuclear Armaments Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

(2) (U) FY 1983 Program:

a. (U) **Close Combat Heavy Mission Area:** During FY 1983 ICAS ballistic cannon will be fabricated and tested. Autoloader concepts for ICAS will be generated, and the most promising fabricated during FY 1984. RAKE test hardware will be fabricated and flight tested. If successfully tested, RAKE will be available for transition to advanced development in FY 1984. 105mm Super Long Recoil Gun will be fabricated and testing initiated in FY 1984.

b. (U) **Fire Support Mission Area:** Concept definition of a 155mm Conventional Geometry Smart Projectile (CGSP) will be completed and laboratory testing of critical components initiated. System architecture for an Integrated Smart Artillery System (ISAS) will be defined incorporating autohandling, improved packaging, and resupply concepts.

c. (U) **Air Defense Mission Area:** During FY 1983 a quick-response turboalternator demonstrator for SENTRY will be designed and fabricated. Optical fuzing for a Short-Range Medium-Altitude Air Defense System (SHOMADS)-type missile will be demonstrated.

d. (U) **High Technology:** Test will be conducted and results of Electromagnetic Rail Gun firings will be analyzed. Pending satisfactory results, testbed activity will progress to advanced development. Joint Army-Navy study on multipoint artillery fuze will be completed.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request:

a. (U) **Close Combat Heavy:** During FY 1984, the ICAS autoloader will be fabricated and tested enabling transition to advanced development in FY 1985. 105mm Super Long Recoil Gun (SLR) effort, initiated in FY 1983, will consist of fabrication of hardware and testing. The SLR Gun will provide reduced trunnion forces and provide light armored vehicles with increased lethality. A concept feasibility demonstration of RAKE will be conducted.

b. (U) **Fire Support:** A concept feasibility demonstration of CGSP will be conducted. ISAS cannon, flick rammer, and gun mount will be integrated and engineering tests initiated. Sighting, Arming, and Fuzing System (SAFS) for Corps Support Weapon System will be integrated and nuclear sighting analysis conducted. First-generation universal modular charges for ISAS, fabricated in FY 1983, will be tested.

c. (U) **Air Defense:** During FY 1984, prototype mechanical and electrical assemblies for the SAFS for SENTRY will be fabricated and integrated. Optical fuzes for SHOMADS-type air defense missiles will be field tested. If successful, this fuze will be available for transition in FY 1985.

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Program Element: #62603A

Title: Large Caliber and Nuclear Armaments Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

d. (U) High Technology: Helical and rail electromagnetic accelerators will be evaluated to determine the best candidate for weaponization. In addition, new techniques for power generation and storage, and switching mechanisms and materials will be evaluated for electromagnetic launchers. Superenergetic materials and new configurations for warheads will be tested to determine potential increases in armor penetration.

(4) (U) Program to Completion: This continuing technology program will demonstrate innovative munition concepts and define ways to improve current systems to extend their useful life. Continuation of exploratory development efforts for artillery, tanks, components, and techniques for future munitions systems.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62617A

Title: Small Caliber and Fire Control Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	10870	9473	9535	10547	Continuing	Not Applicable
AH19	Small Caliber & Fire Control Technology	10870	9473	9535	10547	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: There is a major need to improve the probability of hitting enemy targets on the first and successive rounds, as well as increasing the effectiveness of small caliber ammunition. Fire control components for gun systems offer a significant potential for improving gun accuracy through the application of advancements in electronic devices and new sensors. Small caliber ammunition and guns are high-volume items, and there is a continuing need to seek improvements in material applications and processes to reduce cost and logistics burdens and to improve weapon system producibility and useful life. The objectives of this program are to develop the technology base, exploit new findings, and conceptualize and demonstrate innovative improvements in fire control, automatic cannon weapons, and small arms weapons and munitions systems to meet recognized deficiencies. The scope of the program emphasizes the system-oriented areas of combat vehicles, aircraft, infantry and short-range air defense armaments, as well as developing basic technology in the areas of fire control, armaments, and material applications. Specific investigations develop both hardware and analytic tools necessary to assess system performance, identify problem areas, and address resolution of these problems. The resulting data base forms the foundation for all subsequent fire control and small caliber weapon and munition advanced and engineering developments.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	10870	9473	9535	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	11470	9902	12216	Continuing	Not Applicable

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Program Element: #62617A

Title: Small Caliber and Fire Control Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

The funding decrease of \$600 thousand in FY 1982 is the result of reprogramming to higher priority Army requirements. The funding decrease of \$429 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act and pro rata application of general Congressional reductions to the RDTEA appropriation. A funding decrease of \$2332 thousand in FY 1984 is the result of reprogramming to higher priority Army requirements. The remaining FY 1984 reduction of \$349 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget. The reductions due to FY 1982 and FY 1984 reprogramming were absorbed in the system-oriented technical areas: Short-Range Air Defense; Aircraft Armament; and Combat Vehicle Armament.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not applicable.

E. (U) RELATED ACTIVITIES: The technical areas in this program are related to the following program elements: #62623A (Joint Service Small Arms Program (JSSAP)); #63607A (Joint Service Small Arms Program (JSSAP)); #62603A (Large Caliber and Nuclear Technology (AH18)); #62618A (Ballistic Technology (AH80)); #62203A (Space Aircraft Weapons Technology (DH96)); #62105A (Materials Technology (AH84)); and numerous other advanced and engineering development projects. The coordination with similar efforts conducted by the Air Force and the Navy is accomplished by interagency meetings, Tri-Service reviews, and workshops to encourage information exchange and preclude unnecessary duplication. A Joint Services Small Arms Program has been chartered with membership from the Army, Navy, Air Force, Marine Corps, and Coast Guard to coordinate development of all small arms weapons and munitions. The Laboratory Director chairs the Army fire control technology base planning group which includes active members from all development and readiness commands to assure full coordination, prioritization of activity and the most effective utilization of resources. The Laboratory Director also chairs the Joint Services Working Party for Guns, which reviews, assesses, and coordinates all gun activities, principally automatic cannons, for all the Services. In close cooperation with the US Army Aviation Research and Development Command, a fully integrated helicopter armament technical base program has been developed.

F. (U) WORK PERFORMED BY: The in-house work is conducted at the US Army Armament Research and Development Command facilities located at Dover, NJ. The five largest contractors are the Northrop Corp., Anaheim, CA; Westinghouse Corporation, Baltimore, MD; Heckler and Koch, Arlington, VA; AAI Corporation, Baltimore, MD; and Texas Instruments, Dallas TX. In addition, there are small contracts, with a total value of \$963,000, with 13 other vendors.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AH19 — Small Caliber & Fire Control Technology: This project will provide and maintain a technology base which will lead to advanced development efforts on improved fire control for all gun systems; automatic cannon systems for ground, airborne, and air defense vehicles; improved small caliber munitions; and innovative material applications which will lead to lower cost materials with high reliability and maintainability for gun systems. Principal Accomplishments in FY 1982 included: completion of design and subsystem fabrication of a 35mm armament turret demonstrator for the Bradley Fighting Vehicle System; completed an evaluation of maneuverable projectiles for aircraft armament; fabrication of an acoustic processor and sensor array for passive acquisition of aerial targets; test of an M1 Tank projectile

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Program Element: #62617A

Title: Small Caliber and Fire Control Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

trajectory detection device; formulated and validated a simulation model of a regenerative piston liquid-propellant cannon system; conducted firing test with the AH-1S Cobra Helicopter using a prototype digital turret drive; and completed development of the fire control processor architecture for a prototype integrated processing system. Tasks to be accomplished during FY 1983 and 1984 are: Complete integration and test of the 35mm armament turret demonstrator; begin testbed integration of the passive surveillance system in a ground reconnaissance vehicle; complete subsystem hardware and static tests for a command adjusted trajectory maneuvering projectile; complete software development for the very high speed integrated circuit fire control radar and a prototype integrated processing system; complete design specifications for a conventional high-impulse automatic cannon system; integrate an air defense acoustic detection technology demonstrator on a vehicle; complete formulation of specifications for a prototype air-to-air fire control system for helicopters; complete development of low-cost, short-time-of-flight 40mm air defense ammunition; and complete user demonstration of the digital turret control drive using an AH-1S Cobra testbed.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #82618A

Title: Ballistics Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	25840	20776	17485	20989	Continuing	Not Applicable
AH80	Ballistic Technology	25840	20776	17485	20989	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Research in ballistic technology is dedicated to satisfying specific objectives in the Army Science and Technology Objectives Guide, which serves as a basis for structuring research and development programs at the entry level of the materiel development cycle. This program is needed as a primary source of technology innovations, improvements, and evaluations providing initial definitions of concepts and source of ballistic technology which can be exploited in weapon systems development. Development and maintenance of ballistic and vulnerability technology information bases ensure a solid foundation which can be exploited for initiating and sustaining advanced and engineering development of weapon systems and other Army materiel. Critically important to such development is comprehensive description of ballistic phenomena derived through focussed efforts on closed-system processes, propulsion dynamics, launch and flight dynamics, munition-target interactions, warhead mechanics, penetration mechanics, terminal effects, and armor technology. Vulnerability-lethality efforts seek to quantify susceptibility of targets and materiel to blast, shaped charge jets, kinetic energy penetrators, fragments, flame and incendiary munitions, directed energy weapons, chemical munitions, and radiation to assess lethality of current, development, and postulated weapons, in order to reduce vulnerability of Army materiel and to determine vulnerability of threat targets.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	25840	20776	17485	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	21841	21637	25234	Continuing	Not Applicable

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Program Element: #62618A

Title: **Ballistics Technology**

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

The increase in FY 1982 funds provided support for enhanced efforts in antiarmor penetrator and armor technology research. A funding decrease of \$800 thousand in FY 1983 is a result of reprogramming of funds for High Technology Light Division and reflects the reprogramming of funds to higher priority Army projects. The remaining reduction in FY 1983 resulted from pro rata application of general Congressional reductions to the RDTEA appropriation. The decrease of \$7749 thousand in FY 1984 was caused by reprogramming of funds to higher Army priorities and will reduce efforts in interior ballistics, launch and flight dynamics, terminal effects, lethal mechanisms, and ballistic protection.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Ballistic Technology efforts are coordinated with Navy, Marine Corps, Air Force, Defense Advanced Research Agency (DARPA), Defense Nuclear Agency (DNA), and other Government agencies. Visits by service technical personnel, interagency transfers of information and participation in numerous working groups and committees preclude unnecessary duplication of efforts. Coordination at the Office of Secretary of Defense is achieved through participation in Joint Technical Coordinating Groups, while international coordination is accomplished through active participation in Technical Cooperation Program and through data exchange agreements. This program is related to and is routinely coordinated with Program Element #62603A (Large Caliber and Nuclear Technology), #62617A (Small Caliber and Fire Control), and #62601A (Tank and Automotive Technology), as well as with #61102A (Research in Ballistics).

F. (U) WORK PERFORMED BY: This work is managed by and performed at the US Army Armament Research and Development Command, Ballistic Research Laboratory, Aberdeen Proving Ground, MD. Research efforts will be supplemented by contract support by New Mexico Institute of Mining and Technology, Socorro, NM. Approximately 30 other contractors will receive approximately \$4 million.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: AH80 — Ballistic Technology.

a. (U) Project Description: The objective of this program element is to develop and maintain ballistic technology to ensure a firm basis upon which advanced and engineering development of weapon systems can be initiated and sustained. The capability to describe ballistic phenomena in a comprehensive manner is critically important to successful prosecution of advanced and engineering development of weapon systems. Through this capability, state-of-the-art concepts can be identified, developed, and evaluated with a minimum of costly and time-consuming trial and error experiments. The Ballistic Technology Program consists of efforts in Interior Ballistics where ignition and combustion research is directed to increasing propulsion system performance, eliminating deviations from normal ignition and combustion processes in propellants and reducing munition propellant

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Program Element: #62618A

Title: Ballistics Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

vulnerability; e.g., low-vulnerability ammunition (LOVA) program. Launch and Flight Dynamics includes research in dynamics of projectile flight to enhance flight stability for standard and liquid-filled projectiles, and in interactions between high-pressure gases with the atmosphere; e.g., in work to minimize projectile erratic launch behavior including sabot discard and perturbing effects of muzzle brakes and blast suppressors; Ballistic Protection where results of fundamental research in structural mechanics, material research, and munition-armor interaction mechanisms are exploited to enhance armored vehicle survivability through use of weight-efficient armors and Lethal Mechanisms where efforts are directed to enhanced antiarmor lethality of shaped charge warheads, explosively formed fragments and kinetic energy penetrators. Efforts in Weapon Systems Concepts and Engineering focus on new technical approaches to Army problems, a search for optional weapon system solutions, and comparative analyses of competing weapon systems. Advanced Technology and Concepts Demonstration work includes demonstration of charged particle beam technology essential for tactical Army applications and exploitation of millimeter wave technology to provide solutions to the problems of weapon system operation in a tactically hostile and degraded atmospheric environment and vulnerability and lethality efforts to provide the Army information on weapon systems lethality and vulnerability in support of weapon development, acquisition, use, and maintenance. Formalized vulnerability assessment reduction efforts have enhanced survivability of recently developed Army equipment. Equally significant, these efforts pinpoint and quantify weaknesses in enemy equipment, weaknesses that can be exploited by weapons designers and military doctrine analysts.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Flight tests of 75mm prototype solid-fuel tubular ramjet (SFRJ) vehicles, intended for armor-penetrator training munitions, have demonstrated ability of projectile to auto-ignite and fly in a stable manner. The SFRJ will provide a low-cost, range-limited tank gun training round. Vulnerability-lethality information, vulnerability reduction assessments, and probability of kill data have been provided for more than 200 combinations of ground weapons and targets in response to requests from 33 agencies and contractors including several foreign countries, while 31 studies of aircraft, missiles, and air-cushion landing craft were conducted for Army, Navy, Air Force, and joint Services groups. The BRL has become the focal point in toxic vulnerability analysis (chemical, biological, and residual radioactive) through development of Army Unit Resiliency Analysis (AURA). The AURA family of methodologies exploits vulnerability/lethality analyses to evaluate military unit integrated performance and the time-dependent ability of a military unit to accomplish specific combat missions. A simulation code has been developed to evaluate in detail geometry of intercept between a SMART air defense projectile and an aerial target. This is the initial step in the program to develop an air defense projectile capable of order-of-magnitude improvement in effectiveness. In millimeter wave research, propagation measurements at 35, 95, 140 and 217GHz were performed in SNOW ONE-A exercises. Results have provided snow reflectivity data for signal processing algorithm design by SADARM contractors.

(2) (U) FY 1983 Program: Projected FY 1983 accomplishments in Ballistic Technology include evaluation of new energetic solids to improve performance, lower the cost of, and reduce use of Cyclotrimethylene trinitramine (RDX) in Low-Vulnerability Ammunition (LOVA) propellants. Conduct diagnostic experiments to identify mechanisms and determine effects of hypervelocity impact on LOVA munitions. Develop methodology to

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Program Element: #62618A

Title: Ballistics Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

simulate in-bore behavior of self-righting sabots for projectiles. Evaluate combustion stability, muzzle blast, barrel heat transfer and wear, propellant variability, and environmental effects of unique propellant performance in 30mm fixture. Apply thin-layer Navier-Stokes computational techniques to predict flow for nonaxisymmetric shell. Evaluate characteristics of muzzle flash from full-scale artillery using different propelling charges for range of ambient conditions. Reduce scale of solid-fuel tubular ramjet (SFRJ) to 35-40mm in spin-stabilized device. Improve fabrication processes for composite and textured KE penetrators. Evaluate intermolecular explosives (IMX) performance in small and large caliber shell to assess resistance to cookoff and fragment attack. Provide vulnerability-lethality technology to support Army materiel needs. Develop and validate methodology to assess lightly armored vehicle damage from combined effects; i.e., blast/fragment munitions. Evaluate vulnerability, lethality, and countermeasures for directed energy weapons. Develop unified air/land systems Spare Component Requirements for Combat (SPARC) analysis to improve parts damage assessment methodology. Expand Artillery Control Experiment (ACE) to include Battalion Fire Support Officers. Exploit ACE technology in planning HELBAT-9 exercise. Assess feasibility of fast-burning propellants for SMART air defense (AD) projectile lateral thrusters. Complete preliminary engineering for SMART AD projectile. Evaluate ion-plating of refractory materials onto substrates useful in gun tubes. Evaluate gun barrel wear-reducing additive morphology. Design experiments to validate charged particle beam (CPB) target effects. Complete beam-dynamic evaluations for recirculation devices. Conduct CPB target effects experiments and initiate assessments of countermeasures for CPB damage mechanisms.

(3) (U) FY 1984 Planned Program and Goals for Budget Year Request: Planned FY 1984 Ballistic Technology efforts are ambitious, and the following summary attests to program scope, projected technology accomplishments, and anticipated support for Army weapon systems. Initiate development of low-pressure ignition system for LOVA propellants. Evaluate LOVA artillery charge performance. Complete development of deterrent propellant technology for large caliber guns. Design precision-aim-technique (PAT) helicopter modification kit to evaluate PAT effectiveness for improving gunfire accuracy from rotary-wing aircraft. Complete Phase I of liquid-propellant traveling charge evaluation. Develop technology for analyzing and reducing muzzle blast from cannons using 3-D numerical blast simulation technique. Conduct flight tests of initial design solid-fuel tubular ramjet (SFRJ) projectile. Establish computational capability for predicting aerodynamic behavior of high aspect ratio finned projectiles. Determine effect of hypervelocity kinetic energy penetrator impact on advanced armors. Conduct full-scale ballistic tests of fiber composite penetrators against suite of advanced armor targets. Develop vulnerability blast/fragment effects methodology for aluminum armors. Quantify vaporization effects from this armor. Develop techniques to assess SMART munition lethality against aircraft. Establish data base for estimating effects of chemical attack on combat units. Complete vulnerability-lethality data base development for nonpropagating particle beam weapons. Coordinate a series of field tests with other elements of DARCOM, TRADOC, and Logistics Center to obtain experience with modern military equipment subjected to the violence of full-scale munition tests. The data base generated on contemporary materiel will identify the ravages of combat. The last series of these tests were conducted 20 years ago. Develop cooperative program with Human Engineering Laboratory to exploit Artillery Control Experiment (ACE) for artillery training use. Complete final documentation of tank wars — an armor engagement simulation method. Evaluate anomalous energy transport phenomena in explosives. Develop correlated (IR/mm wave) sensor clutter descriptions for cultural clutter in builtup areas. Employ reactive ion-plating to improve hypervelocity bullet performance. Complete initial experimental evaluation of charged particle beam target effects phenomena.

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Program Element: #62618A

Title: Ballistics Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

(4) (U) Program to Completion: This is a continuing program of exploratory development to develop and maintain a ballistics technology base assuring a solid foundation upon which advanced and engineering development and product improvement programs of weapon systems can be initiated and sustained.

c. (U) Major Milestones: Not Applicable.

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DESCRIPTIVE SUMMARIES OF THE RESEARCH DEVELOPMENT TEST
& EVALUATION ARMY... (U) DEPUTY CHIEF OF STAFF FOR
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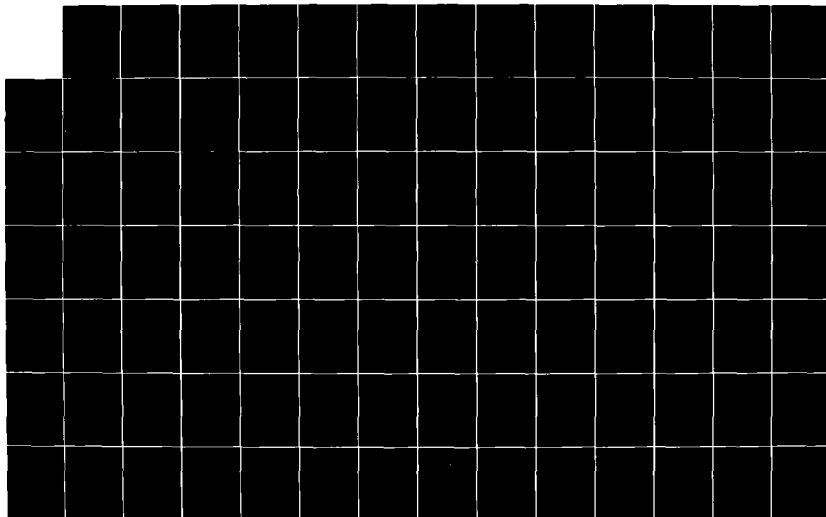
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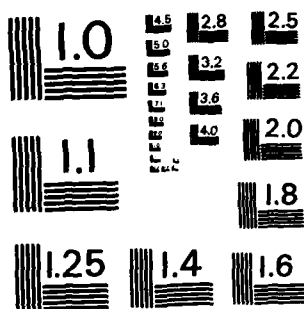
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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62622A

Title: Chemical and Smoke Munitions

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	20214	12793	12959	15148	Continuing	Not Applicable
A552	Smoke and Obscurant Munitions	- 0 -	5046	3889	3977	Continuing	Not Applicable
A554	Chemical Munitions	20214	7747	9070	11171	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Soviet Union is in the process of developing and fielding an impressive array of weapon sights, guided munitions, target acquisition devices, and surveillance systems. These systems operate throughout the electromagnetic spectrum and include image intensification, infrared (IR), and millimeter-wave (radar) systems. These systems pose a significant threat to the survivability of US forces on the modern battlefield. Additionally, there are indications that the Soviets are developing directed energy weapons such as lasers which also operate in portions of the electromagnetic spectrum. One of the most effective countermeasures against those threat systems is the use of smokes and obscurants. Unfortunately, currently fielded smoke systems were largely developed before and during World War II and are not capable of providing the rapid, broadband, long-duration screening required for our armored vehicles, critical installations, assembling forces, and logistical complexes to survive on the modern battlefield. Current systems are effective only in the visual portion of the electromagnetic spectrum and marginally effective in the IR portion. This program element addresses the urgent need to provide the user with smokes and obscurants to reduce the vulnerability of US forces by defeating or degrading threat weapon sights, guided munitions, target acquisition devices, surveillance systems, and directed energy weapons. The program provides for the conduct of exploratory development in smoke and obscurant agents, munitions, and devices.

The Soviet Union has long recognized and appreciated the ability of chemical-biological (CB) weapons to inflict casualties, degrade combat effectiveness, and disrupt the battlefield. The USSR continues to maintain and improve its formidable capability to conduct CB operations. Consequently, the US military must have the capability to survive and conduct sustained operations in a CB warfare environment. However, this capability alone would leave the US military at a significant disadvantage in a chemical warfare (CW) environment. While CW-protective equipment saves lives, even improved protective equipment degrades military performance in a CW environment. Reliance solely on protective equipment allows an opposing force to initiate CW and operate largely free of the encumbrance of protective equipment, thereby yielding them a significant military advantage and encouraging their initiation of CW. The US has been unable to eliminate the CW threat through negotiation. Other capabilities — in particular nuclear — cannot be relied on to deter CW in view of the overall military balance between the US and the Soviet Union. Thus, in addition to improving our defenses, we must maintain a credible capability to retaliate with chemical weapons. This contributes to deterring CW by eliminating the opposing forces' advantage

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Program Element: #62622A

Title: Chemical and Smoke Munitions

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

of operating largely free of the encumbrance of protective equipment. The US already maintains a chemical stockpile; however, this stockpile is mostly unusable bulk agent, includes munitions for obsolete or soon-to-be-obsolete delivery systems, would be relatively ineffective against threat rear echelons, imposes major logistic burdens in transportation, and is difficult to demilitarize. The Army has been assigned Executive Agent responsibility for conducting CW research and development for the Department of Defense. This program addresses the urgent need to provide a credible deterrent to CW. To accomplish this goal, it will be necessary to replace the current stockpile with munitions that will be compatible with current and developmental delivery systems, provide a rear-echelon attack capability, minimize the transportation logistic burden, and facilitate demilitarization. The program provides for the conduct of exploratory development for all the Services in chemical agents, chemical agent effects, and chemical munitions.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	20214	12793	12959	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	18468	14829	16810	Continuing	Not Applicable

The FY 1982 increase of \$1746 thousand was required to exploit recent advances in smokes and obscurants and complete development of a medium-altitude proximity fuze needed for effective dissemination of thickened chemical agents. The funding decrease of \$2036 thousand in FY 1983 is the result of Congressional direction in the FY 1983 Appropriations Act and pro rata application of general Congressional reductions to the RDTE, A appropriation. The FY 1984 decrease of \$3851 thousand is the result of program planning adjustments from the chemical warfare deterrent and smoke and obscurant programs to other, higher priority Army requirements, and a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Department of Defense Directive 5160.5 assigns the Army responsibility for research, exploratory development, and advanced development in chemical warfare for all Services, for engineering development for the Army and for joint requirements of the Army with other Services, and for all development of chemical agents. In order to meet other Services' needs and to prevent unnecessary duplication of effort, execution of this responsibility is coordinated through the Joint Developments Objectives Guide (JDOG), joint working groups, and periodic joint reviews of the Joint Chemical-Biological Research, Development, Test, and Evaluation Program. To meet other Services' requirements and avoid

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Program Element: #62622A

Title: Chemical and Smoke Munitions

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

duplication of effort in smokes and obscurants, liaison personnel for each Service monitor the developing agency's programs. Coordination and cooperation is maintained with allied countries through data exchange agreements and with the North Atlantic Treaty Organization (NATO). Succeeding advanced development efforts are performed under Program Elements #63627A (Combat Support Munitions) and #63615A (Lethal Chemical Munitions Concepts).

F. (U) WORK PERFORMED BY: In-house work is performed by Chemical Systems Laboratory, Aberdeen Proving Ground, MD. Contractors include Ash Stevens Incorporated, Detroit, MI; Batelle, Columbus, OH; Foxboro Analytical, South Norwalk, CT; Brunswick Incorporated, Marion, VA; Southern Research Institute International, Birmingham, AL; Barnes Engineering, Stanford, CT; Aerodyne Research, Burlington, MA; R&D Associates, Santa Monica, CA; Rahtech, Madison, WI; American Histological Laboratories, Bethesda, MD; and Stanford Research, Menlo Park, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) **A552 — Smoke and Obscurant Munitions:** This project supports exploratory development (XD) efforts in smoke and obscurant agents, munitions, and devices to reduce the vulnerability of US forces by defeating or degrading threat weapon sights, guided munitions, target acquisition devices, surveillance systems, and directed energy weapons. During FY 1982, thirteen candidate infrared (IR) and multispectral-defeating aerosols were identified, testing facilities were upgraded to measure performance in the millimeter wave (radar) region, two multispectral screening generators were evaluated, a contract was awarded to scale up the multispectral generators for a FY 1984 field test, and an evaluation of emissive IR-defeating smokes was begun. During FY 1983, performance and trade-off analyses will be conducted, and the baseline design will be selected for the IR-defeating 81mm mortar cartridge, IR-defeating vehicle engine exhaust system, and IR-defeating smoke pot; efforts to scale up the multispectral generator will continue; the effects of new smokes and obscurants on high-energy laser propagation will be studied; and the evaluation of emissive IR-defeating smokes will continue. In FY 1984, the exploitation of emissive IR-defeating smokes will begin, performance and trade-off studies will be completed, and the baseline design selected for the IR-defeating 155mm projectile, a field test of the scaled-up multispectral generator will be conducted to demonstrate the technology, weaponization of multispectral screening materials will begin, studies of the effects of smokes and obscurants on high-energy laser propagation will continue, and a study of countermeasures against microwave beams will be initiated.

2. (U) **A554 — Chemical Munitions:** This project supports exploratory development (XD) efforts in chemical agents, chemical agent effects, and chemical munitions to deter the threat of chemical warfare by developing a credible retaliatory capability. This project addresses the urgent need to replace the current stockpile with munitions which will be compatible with current and developmental weapon systems, provide a rear echelon attack capability, minimize the transportation logistics burden, and facilitate demilitarization. During 1982, the Multiple Launch Rocket System (MLRS) Chemical Warhead XD effort was completed and the warhead made the transition to advanced development, research studies on thickeners and stabilizers for thickened chemical agents were continued, the XD effort to develop a Medium-Altitude Proximity fuze needed for effective dissemination

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Program Element: #62622A

Title: Chemical and Smoke Munitions

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

of thickened agents was completed and the fuze transferred to advanced development, efforts in support of the development of a chemical warhead for the Joint Tactical Missile System (JTACMS) (formerly Corps Support Weapon System) were continued, preparations were completed to contract for an investigation of submunition designs for large missiles, a chemometrics analysis and modeling program to aid in identifying new lethal agents was initiated, and a program to evaluate protective-mask-defeating chemical agents was initiated. In FY 1983, the chemometrics analysis and modeling program will be used to assist in identifying new chemical agents to be synthesized and tested, studies of agent thickeners and stabilizers will be continued, and the investigations of new chemical agents capable of defeating chemical-biological defense equipment will be continued. As a result of Congressional action with respect to the FY 1983 appropriation, the planned FY 1983 toxicology studies of the binary Intermediate Volatility Agent (IVA) needed to field the Multiple Launch Rocket System (MLRS) Chemical Warhead and efforts to develop dissemination methods and submunition designs for the Joint Tactical Missile System (JTACMS) Chemical Warhead will be largely deferred to FY 1984. During FY 1984, the preparation of an expanded data base on the effects of low doses of chemical agents will be completed, and the fill and closure studies to support manufacture of the Multiple Launch Rocket System Chemical Warhead will be completed. The chemometrics analysis and modeling program will be continued, and promising new chemical agents identified by the program will be synthesized and tested. The investigations of new chemical agents capable of defeating threat chemical-biological defense equipment will also be continued. The primary focus of this program is to develop agents or additives to current agents which will defeat the protective mask although consideration is also given to agents which cannot be detected or decontaminated. The ultimate goal of this program is to develop a decisive deterrent against the initiation of chemical warfare. The Joint Tactical Missile System (JTACMS) Chemical Warhead exploratory development program will resume. This program will provide a chemical deterrent system with greater range and area coverage than can be provided by the Multiple Launch Rocket System and which can be used to retaliate against key deep targets such as logistics complexes and command and control centers. The investigation of thickeners and stabilizers for chemical agents will continue. This program is developing improved binary intermediate volatility agents which will provide both respiratory and contact hazards and will have increased volatility and greater stability in storage. The toxicology studies of the binary Intermediate Volatility Agent (IVA) needed to field the Multiple Launch Rocket System (MLRS) Chemical Warhead will be resumed and completed in FY 1984.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62623A

Title: Joint Service Small Arms Program (JSSAP)

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0* -	3696	4342	4475	Continuing	Not Applicable
AH21	Joint Service Small Arms Program (JSSAP)	- 0* -	3696	4342	4475	Continuing	Not Applicable

*FY 1982 effort was a portion of Program Element #62617A (Fire Control and Small Caliber Armaments Technology), Project #AH19 (Small Caliber and Fire Control Technology), Tech Area A, (JSSAP).

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This effort provides a coordinated program for the exploratory development of small arms weapons required by all Services in meeting the current and future battlefield threat. In the face of new and changing threats, maintaining a credible capability to respond effectively at any level of conflict requires continuing advancement of small arms technology and its supporting sciences. This program will ensure that the US fighting man is adequately armed on the modern battlefield. JSSAP supports the Army close combat light mission area, specifically addressing deficiencies for light forces and special operations forces, the Marine Corps, Air Force security police, and Navy special operation forces mission areas.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	- 0 -	3696	4342	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	- 0 -	3706	2113	Continuing	Not Applicable

The funding decrease of \$10 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. The funding increase of \$2229 thousand in FY 1984 is a result of a change in program scope to enhance competition with the addition of a second competitor.

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Program Element: #62623A

Title: Joint Service Small Arms Program (JSSAP)

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This effort is related to Program Element #62617A (Small Caliber and Fire Control Technology) and Program Element #63607A (Joint Service Small Arms Program (JSSAP)). The Joint Service Small Arms Program (exploratory development — 6.2/nonsystem advanced development — 6.3A) was created to assure that there is no unnecessary duplication of small arms efforts within the Department of Defense and to adequately address all Service small arms needs. Full coordination among all the Armed Services is maintained by the JSSAP Management Committee and joint Service working groups representing the user, developer, and evaluator communities. Program scope and activities are governed by the Memorandum of Agreement on the Management of Multi-Service Systems/Programs/Projects and Department of Defense Directive 5000.1, Major System Acquisitions.

F. (U) WORK PERFORMED BY: This exploratory development program is under the management of the Joint Service Small Arms Program. The prime in-house organization responsible for the program is the US Army Armament Research and Development Command, Dover, NJ, with other major efforts at: The Naval Weapon Support Center, Crane, IN, and the Air Force Armament Technology Laboratory, Eglin AFB, FL. Primary contractors for JSSAP exploratory development activities are: Battelle Memorial Institute, Columbus, OH; AAI Corp, Cockeysville, MD; and Heckler and Koch, Inc., Arlington, VA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AH21 — Joint Service Small Arms Program (JSSAP): Funding constraints have dictated that the principal exploratory thrust by the JSSAP will be the advanced combat rifle (ACR) project. All the Services have formally expressed the need for a significantly improved/revolutionary combat rifle. The advanced combat rifle will provide significantly increased hit probability in all battlefield environments while increasing the combat ammunition load at an overall weight equivalent to the current M16 rifle. These improvements will be accomplished by the development of caseless ammunition, improved projectiles, salvo delivery, and single-point day/night sight. A Joint Service Science and Technology Objective (JSSTO) for the ACR was approved by the JSSAP Management Committee in April 1982. The ACR program was initiated in FY 1983 with a dual contract effort for concept definition and development of feasibility hardware. The FY 1984 effort will encompass the delivery of technology demonstrator hardware suitable for testing and evaluation. A very limited effort addressing future alternatives to the conventional combat rifle beyond the year 2000 will continue. This is a Defense Advanced Research Projects Agency (DARPA)/JSSAP initiative. Promising technologies were identified in FY 1982, and concepts will be identified for potential development during FY 1983. No other exploratory development efforts are anticipated at currently projected funding levels.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62701A

Title: Communications Technology

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	7000	8695	16339	23816	Continuing	Not Applicable
AH92	Communications Technology	7000	8695	16339	23816	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The next generation of evolving weapon and fire control systems have urgent needs for communication capabilities which the current inventory of fielded equipment cannot provide. The heavy emphasis on digital and mixed analog/digital data used in these systems creates serious problems in areas of information distribution, signal processing, signal quality, electromagnetic compatibility (EMC), propagation, spectrum management, and system interoperability. Only the application of new technologies such as fiber optics, millimeter waves, spread spectrum, data distribution, and Very High Speed Integrated Circuits (VHSIC) will begin to solve these problems. These problems cover tactical communications needs for: improved mobility, reliability, and survivability; reduced vulnerability to enemy electronic countermeasures (ECM) and nuclear blast impact; reduced cost for communications security; low probability of interception; and dispersed command posts (CP) and communications hardware. To support the combat user, the tactical communications system must provide rapid operational response via automated message and voice switches, and improved teleprocessing centers which automatically relay data, teletype, voice, and facsimile messages from the sender to the intended receiver(s). This requires terminal devices which match the system to the man more efficiently. This program must develop the required technologies which will produce systems with the required capabilities at affordable and reduced costs. Exploratory development work in command, control, and communication (C³) systems is essential to develop the advanced concepts required to offset enemy manpower advantages through effective use of high-technology systems. Hence, this entire program element contributes directly to the major Army thrust towards Distributed Command, Control, Communications and Intelligence (DC³I). This work also provides input for the continuing improvement of current and near-term system capability and survivability. This work must also develop the specialized system engineering tools and assessment methodologies specifically designed to enable competent and decisive analysis of competing high-technology approaches.

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Program Element: #62701A

Title: Communications Technology

DOD Mission Area: #521 — Electronic and Physical Sciences (ED)

Budget Activity: #1 — Technology Base

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	7000	8695	16339	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	7545	9719	8931	Continuing	Not Applicable

Reduction of \$545 thousand in the FY 1982 funding level is a result of reprogramming to higher priority Army requirements. The funding decrease of \$1024 thousand in FY 1983 is a net result of a \$24 thousand decrease from pro rata application of general Congressional reductions to the RDTE.A appropriation and a \$1000 thousand decrease from Congressional direction in the FY 1983 Appropriations Act. The funding increase of \$7408 thousand in FY 1984 is a net result of: a \$7869 thousand increase due to reallocation of funds primarily in support of the major Army thrust towards Distributed Command, Control, Communications, and Intelligence (DC²); an \$88 thousand increase from revised civilian pay pricing indices; and a reduction of \$549 thousand which resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE program.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program provides the exploratory development needed to support the following: Program Element (PE) #63701A (Communications Development), Project #D246 (Tactical Communications Systems Development), and Project #D437 (Advanced Communications Concept Development); PE #63723A (Command and Control), Project #D180 (Dispersed Command Post Prototype); PE #64701A (Communication Engineering Development), Project #D487 (Tactical Multichannel Communications), and Project #D488 (Tactical Net Radio Communications); PE #28010A (Joint Tactical Communications Program (TRI-TAC)), Project #D104 (TRI-TAC Office), Project #D107 (MOD To Army TRI-TAC Interface), Project #D110 (Mobile Subscriber Equipment), Project #D119 (Modular Record Traffic Terminal), and Project #D222 (Automatic Communications Central Office — AN/TTC-39); PE #64779A (Joint Interoperability of Tactical Command and Control System (JINTACCS)), Project #D323 (Systems Engineering for Army Tactical C3 Systems); and PE #63207A (Aircraft Avionics Equipment). PE #61102A (Defense Research Sciences), Project #AH48 (Communications Research), provides the basic research support for Project #AH82. Coordination is conducted with the Defense Advanced Research Projects Agency, US Army Training and Doctrine Command, and XVIII Airborne Corps for concept formulation of an Army Battlefield Information Distribution (BID) System using currently available packet radio technology. There is no unnecessary duplication of effort within the Army or Department of Defense. Duplication is avoided by attendance at military and scientific conferences.

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Program Element: #62701A

Title: Communications Technology

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

F. (U) WORK PERFORMED BY: Motorola Inc., Scottsdale, AZ; SRI International, Menlo Park, CA; Jet Propulsion Laboratory, Pasadena, CA; Illinois Institute of Technology (IIT) Research Institute, Chicago, IL; MITRE Corp., McLean, VA. Twenty-three other contracts will be awarded during FY 1984 with a total value of \$8,816,274. In-House developing organizations are U.S. Army Communications-Electronics Command, Ft. Monmouth, NJ, and DOD Electromagnetic Compatibility Analysis Center (ECAC), Annapolis, MD.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: AH92 — Communications Technology

a. (U) Project Description: Present communications technology does not meet today's Army needs. Problems of excess weight, size, power drain, cross-talk, electromagnetic (EM) Pulse and the EM and Electronic Countermeasures (ECM) threat (both passive and active), reliability, and low channel capacity require application of advanced technology. The approach to solving these problems is to develop new methods and techniques needed for future Army Communication-Electronic (C-E) systems. This effort requires exploration of the following: fiber optic and millimeter wave (MMW) and microwave communication; techniques for handling, multiplexing, and storing information; system technology; radio wave propagation; net communications to exploit the latest state-of-the-art with emphasis on antennas and high-frequency (HF) communications; packet radio; network management; switching technology; information acquisition processing (speech, print, picture); channel (spectrum) optimization; and interference (EMI) and compatibility (EMC) technology. Technology improvements in these areas will form the basis for system and subsystem design for effective integration and transition planning. This project addresses these problems within the framework of several concepts/architectures to insure the realization of: distributed command and control; adequate spectrum management; and a survivable Army Command and Control System (ACCS). The Command and Control Information Utility (CCIU) is an overall framework for the development of distributed processing capabilities essential to dispersal of cellular command posts and replication of data bases among operational facilities to enable continuity of operations. Other concepts are the Army Tactical Frequency Engineering System (ATFES) and the Army Battlefield Spectrum Management and Engineering (ABSME) architectures which identify near-term and far-term solutions to radio frequency (RF) spectrum management/optimization essential to minimize the effects of spectral pollutions and self-jamming. Use of a Computer-Aided Design (CAD) methodology provides a maintainable data base/library of system engineering tools essential to critically evaluate newly evolving technology. This insures that systems engineering/integration rectifies shortfalls rather than creates new ones. Finally, the development of presentation aids and decision graphics methods will provide commanders with interactive facilities. These will reduce their paperwork, increase reactive speed, increase decision accuracy, allow them to factor in judgmental values via interactive modes, and give them the capability to cope effectively with the increased speed and sophistication of modern warfare.

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Program Element: #62701A

Title: Communications Technology

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

b. (U) Program Accomplishments and Future Efforts:

(1) (U) **FY 1982 Accomplishments:** Demonstrated intrusion-resistant fiber optic (FO) cable with AN/TTC-42 prototype switchboard and developed FO splice procedures and special housing. Started development program for optical wavelength division coupler to permit data voice and video on existing TRI-TAC multichannel systems. Completed three contracts on state-of-the-art advances for millimeter wave (MMW) mobile intercept-resistant radios (MISR). Completed simulation of MMW wireless command post system and incorporated results in contract specification. Completed packet radio interfaces and provided measurement software/hardware successfully used at HELBAT-8 exercise, Ft. Sill, OK. Completed procurement data for investigation of packet switching overlay on tactical multichannel and satellite connection to Battlefield Information Distribution System (BIDS) nets. Successfully developed and tested packet radio interfaces to Operational Tactical Data Systems (OPTADS) computer terminals/systems. Fabricated optical telephone feasibility model using mike, earphone, and ringer techniques. Completed final design plans for digital microwave components and started hardware development. Developed electronic counter-countermeasure (ECCM) waveforms for high-frequency (HF) radio program. Designed three tactical HF antennas for testing by Special Forces. Started contract to develop the Wideband Propagation Measurement System (WPMS) and completed initial tests for HF frequency management and forecasting (PROPHET). Completed contract to develop electromagnetic interference measurement techniques for MMW equipment. Completed contract for intrasystem electromagnetic compatibility (EMC) analysis model. Updated System Architecture Concept Document to incorporate the current baseline for distributed processing of the Army Battlefield Command and Control Information Utility (CCIU), which provides for replication and migration of fail-safe functions and data bases between processing facilities. Successfully demonstrated the concept of a cellular command post in which twin cells provide mutual backup. Of the five functional segments of the Army Command and Control System (ACCS), the Air Defense, Fire Support, and Maneuver Control were completed. Developed spectrum management algorithms to improve VHF and HF radio Communications-Electronics Operating Instructions (CEOI) generation and distribution as well as for the Army Tactical Frequency Engineering System (ATFES) deployed by USAREUR.

(2) (U) **FY 1983 Program:** Complete the development and evaluation of the optical wavelength coupler and FO expedient splice/repair kit. Move MMW MISR program into advanced development. Continue contract on wireless command post for the MMW Wireless Intracell Communication System (WICS). Start phased array antenna development for the Digital Microwave Radio (DMR) and complete DMR efforts on the spread spectrum modem, system design, coding, and steerable null antenna. Start effort for MMW Covert Cableless C² for Weapons Systems and start UHF ECCM techniques (AN/GRC-103). Continue work in network management integration and spread spectrum low-probability-of-intercept (LPI) techniques. Start effort for integration of packet switching and network protocols into the Army communication system. Start contracts for packet switch overlay, Very High Speed Integrated Circuits (VHSIC) antijam (AJ) modem, low-cost packet radio for position location, HF modem, and near vertical incidence HF antenna. Start effort for the frequency-hopping antenna multiplexer. Continue efforts on wideband propagation and HF frequency management and propagation. Continue work in EMC spread spectrum analysis, and start new efforts on interference (EMI) in microprocessors and frequency-hopping. Continue to explore development of more reliable and efficient distributed processing, spectrum management, and techniques for a

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Program Element: #62701A

Title: Communications Technology

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

survivable Army battlefield communications system as discussed in project description. Communications-Electronics Operating Instruction (CEOI) storage and distribution techniques as well as techniques for automated frequency assignment and interference prediction will also be investigated in conjunction with field experiments in USAREUR using the ATFES pilot system elements at the 7th Signal Brigade, VII Corps, and 3d Infantry Division.

(3) (U) FY 1994 Planned Program and Basis for Budget Year Request: Complete effort on the fractional dB fiber optic (FO) for and start new FO power techniques and single-fiber communications links. Complete the phased array antenna effort and continue work on ECCM techniques. Continue MMW efforts for WICS and Covert Cableless C² for Weapons System. Start efforts in submillimeter communication, ultraviolet communications, radio performance monitor, MMW susceptibility, and MMW Very Intelligent Surveillance and Target Acquisition (VISTA) communications. Investigate distributed adaptive net management for large networks. Start contracts for distributed packet switching, information distribution networks, and PLRS/JTIDS Hybrid (PJH) enhancement. Complete the packet switch overlay contract. Continue the spread spectrum LPI, low-cost packet radio, and VHSIC AJ modem efforts. Start efforts for multilevel secure networking, VHSIC technology exploitation, and high-altitude communications platform. The HF modem and near vertical incidence antenna developments will be completed. Start contracts for exploratory models of the frequency-hopping antenna multiplexer, and to develop validated numerical electronic codes for antenna design. The Wideband Propagation Measurement System (WPMS) will be delivered, field tests will start in the US, and plans made for field tests outside the US. Electromagnetic compatibility/electromagnetic interference (EMC/EMI) efforts will continue on spread spectrum, frequency-hopping, and microprocessor susceptibility. The CCIU development will continue with demonstration and testbed definition. Experimental packetization will be available for subsequent system engineering and integration into JTIDS, PLRS, SINCGARS, and TRI-TAC. ATFES will be integrated into the evolving Army Command and Control System (ACCS) and the TRI-TAC Communications System Control Element (CSCE). Techniques to realize survivable systems will be evaluated using the Computer-Aided Design (CAD) methodology.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62703A

Title: Combat Surveillance, Target Acquisition and Identification

DOD Mission Area: #521 — Electronic and Physical Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2544	2910	5391	8236	Continuing	Not Applicable
AH93	Combat Surveillance, Target Acquisition and Identification	2544	2910	5391	8236	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The basic Army need for this effort is to provide the commander with the capability to effectively sense, understand, evaluate, and predict any real or potential enemy threat on the battlefield. This program provides the technology base for new concepts and advanced systems for the solution of presently unsolved surveillance, target acquisition, and identification requirements. These include developing modular radar componentry to reduce size and cost and to increase performance and reliability; multistatic radar system for increased surveillance and reduced cost; noncooperative battlefield identification friend or foe; radar techniques to identify stationary and moving targets and provide an all-weather capability; passive acoustic techniques to rapidly locate hostile artillery; and integrating surveillance and target acquisition sensors to provide fused output. It also identifies the most promising alternatives to fill existing operational gaps in the Army's integrated surveillance, target acquisition, and identification capability. An extended objective is to immediately address the new Army thrust in Very Intelligent Surveillance and Target Acquisition (VISTA) systems and execute timely technology insertion to meet the FY 1987 demonstrations. Exploratory development is performed in the following technological areas: personnel and vehicle detection; identification; weapons location; detection and measurement of nuclear radiation and bursts; and the integration of surveillance and target acquisition sensors.

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Program Element: #62703A

Title: Combat Surveillance, Target Acquisition and Identification

DOD Mission Area: #521 — Electronic and Physical Sciences (ED)

Budget Activity: #1 — Technology Base

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2544	2910	5391	Continuing	Not Applicable
Funds (as shown in FY 1983 Submission)	2214	2918	4883	Continuing	Not Applicable

Funding differences between this year's Summary and last year's are due primarily to program restructuring necessary to include additional efforts in the Very Intelligent Surveillance and Target Acquisition arena. As outlined in paragraph B above, VISTA is a new Army thrust to apply technological advantage to weapon system development. The funding decrease of \$8 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE,A appropriation.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Work is coordinated during reviews conducted by the Office of the Under Secretary of Defense for Research and Engineering, through interlaboratory visits and communications, attendance at specialized scientific meetings and conferences, inter-Service liaison, technical reports, and the Annual Tri-Service Radar Symposium. This coordination assures that there is no unnecessary duplication of effort within the Army or Department of Defense.

F. (U) WORK PERFORMED BY: In-house work is performed by the US Army Electronics Research and Development Command at Fort Monmouth, NJ, and at Adelphi, MD. Contractors include Georgia Institute of Technology, Atlanta, GA; RCA, Princeton, NJ; Hughes Aircraft Company, Culver City, CA; Malibu Research Associates, Santa Monica, CA; Lincoln Laboratories, Bedford, MA; Radiation Measurement Devices Inc., Watertown, MA; Science Applications Inc., San Diego, CA; Nuclear Research Corporation, Denville, NJ; R & D Associates, Rosslyn, VA; Technology Services Corporation, Santa Monica, CA; and Raytheon Corporation, Waltham, MA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AH93 — Combat Surveillance Target Acquisition and Identification: This project funds the exploratory development performed by the Combat Surveillance and Target Acquisition Laboratory and Harry Diamond Laboratories. Major areas are development of radar techniques for the detection, classification, and identification of stationary nonfiring targets under all visibility conditions;

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Program Element: #67

Title: **Combat Surveillance, Target Acquisition and Identification**

DOD Mission Area: #521 — **Electronic and Physical Sciences (ED)**

Budget Activity: #1 — **Technology Base**

development of radar techniques for the classification and identification of moving targets under all visibility conditions and through foliage; development of lightweight, low-cost, common radar modules to lower life cycle costs to future radar systems due to commonality in logistics, maintenance, and training requirements; development of lightweight, electronically scanned antennas and side lobe cancellers for improved performance and electronic countermeasure (ECM) capabilities; development of multistatic radar concepts and hardware as part of the joint Army/DARPA Bistatic Alerting and Cueing (BAC) radar program; development of a low-cost, multipurpose, tactical radiation measurement device to perform the functions presently requiring several separate devices; investigation of noncooperative battlefield identification friend or foe; and weapons location technology with emphasis on a passive, automated, linear base, acoustic, artillery target location system to replace the current manual system. FY 1982 accomplishments: Continued technological support to ongoing development programs. A ground radar testbed was completed and tested which uses solid state transmitter-receiver, charge-coupled device radar signal processor, and tilted-beam antenna. Vehicular-mounted low-probability-of-intercept (LPI) locators were tested against emitter locators and jammers. An airborne radar testbed was used to develop and evaluate technology for airborne radars such as RPV, JSTARS, OV-1, and SEMA-X to improve target detection, identification, tracking and acquisition capabilities. Efforts to classify stationary targets included evaluation of three polarimetric discrimination algorithms and initiation of Hostile Weapons Location System (HOWLS) radar stepped-frequency data processing. A new wheel/track algorithm for operation at higher signal-to-noise ratios was initiated using Surveillance Target Acquisition Radar for Tank Location and Engagement (STARTLE) data. Prototype fiber optic dosimeters and reader were designed and additional cadmium telluride (CdTe) work and neutron experiments were accomplished under existing contracts. The BAC radar system design was completed on schedule, and some components and the antenna subsystems were constructed. FY 1983 plans: Complete development of STARTLE wheel/track algorithm. Begin system and signal processing design for the modular radar; repair and upgrade the transmitter of the SOTAS emulator and define VISTA interfaces; perform technology trade-off studies for the lightweight E-SCAN antenna, and design a demonstration model. Start processing Moving Target Indication (MTI) data at high frequencies. Complete noncoherent, single polarization stationary target discrimination/classification algorithms and test them in the airborne radar testbed signal processor. Initiate collection of acoustic data base for artillery and helicopter targets. Initiate contracts for preliminary design of dose rate detectors. Assemble the BAC radar system and perform local integration tests; field testing will take place at China Lake, CA, later in the year. FY 1984 plans: Continue work on stationary and moving target detection and identification, and on noncooperative battlefield identification, electronically steerable antenna technology. Continue collection of acoustic signature data base for artillery and helicopters. Continue gamma dose rate effort. Develop dedicated emitter requirements and study digital beam-forming techniques for the BAC radar; begin construction of radio-frequency and processor assemblies for modular radars and specify display and interfaces; complete VISTA interface design and processor for SOTAS emulator; evaluate E-SCAN antenna performance; design sidelobe canceller processor and antenna elements. Program to completion: This is a continuing level-of-effort program.

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Program Element: #62703A

Title: **Combat Surveillance, Target Acquisition and
Identification**

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62704A

Title: Military Environmental Criteria Development

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2674	2577	2937	3081	Continuing	Not Applicable
AF25	Military Environmental Criteria Development	2674	2577	2937	3081	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The methods and technology developed by efforts conducted under this program element are required to support the Army's efforts to prevent any contamination from its installations or operations affecting the health or environment of communities near such installations. The program emphasizes the development of analytical techniques for identification and quantification of contaminants; research to characterize contaminants, determine their toxicities, and provide data for the establishment of technology developments which will support containment/decontamination efforts at Army and other Department of Defense installations as problems are identified and plans are approved.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2674	2577	2937	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	2755	2584	3378	Continuing	Not Applicable

In FY 1982, the reduction of \$81,000 in current requirements was due to reprogramming to higher priority Army programs. In FY 1983, the \$7,000 reduction is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. In FY 1984, the \$441,000 reduction is a result of reprogramming to programs having higher priority.

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Program Element: #62704A

Title: Military Environmental Criteria Development

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Conduct of the Installation Restoration (IR) Program and efforts to preclude duplication of effort involve extensive interface with a significant number of other DOD and Government organizations. These include the Departments of State, Health and Human Services, Agriculture, Transportation, Interior, US Nuclear Regulatory Commission, Environmental Protection Agency, National Academy of Sciences, Department of Defense (DOD) Explosives Safety Board, and state and local governments. On 23 July 1976, the Department of the Army was designated as the lead Service for the compilation and refinement of applicable technology and the development of new or improved technology and criteria or standards for the DOD installation restoration program as it relates to all contamination, including chemical, biological, and radiological. This mission is the assigned responsibility of the US Army Toxic & Hazardous Materials Agency. No duplication of effort occurs within the Army or the Department of Defense. A Tri-Service Installation Restoration Technology Coordinating Committee has been chartered to assure and effect coordination. A Memorandum of Understanding also exists between the Army and the Environmental Protection Agency covering research cooperation in the area of toxic and hazardous materials remedial actions. This program is related to Program Element #62720A (Environmental Quality technology), which supports the Army's efforts to achieve compliance with environmental laws and regulations.

F. (U) WORK PERFORMED BY: Approximately 20 percent of the work is performed in-house by the US Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD; the US Army Medical Bioengineering Research and Development Laboratory, Ft Detrick, Frederick, MD; Chemical Systems Laboratory, Aberdeen Proving Ground, MD; and Natick Laboratories, Natick, MA. The remainder is performed by contractors such as: Environmental Sciences and Engineering, Gainesville, FL; Engineering Sciences Inc., McLean, VA; Roy F. Weston, Inc., West Chester, PA; and Battelle, Columbus, OH.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AF25 — Military Environmental Criteria Development: The single project which comprises this program element emphasizes the development of analytical systems and procedures, the establishment of safe criteria for contaminants, and the development of technology for safe containment and decontamination. This research is necessary for effectively carrying out the Army program to prevent contamination from Army activities migrating beyond installation boundaries. FY 1982 accomplishments include: Increased effort was directed toward the development of analytical methods for the identification and quantification of 7 chemical compounds found in the soil, water, and process waste disposal facilities. Methods for extraction and preservation of samples, as well as the development of standard analytical reference materials for use in laboratory quality control and measurement were developed. In the Contaminant Level Criteria Development area, problem definition studies, toxicity screening and follow-on toxicity studies were performed on chemical compounds found in the soil, water, process waste disposal facilities, and biological tissues at the Army installations undergoing contamination surveys. Additionally, 7 candidate compounds received hazard analysis and 3 toxicity screens were conducted. The primary development effort for decontamination/containment technology involved the development of a treatment method for explosive contaminated lagoon sediment. In addition, techniques that apply in situ and excavated processing, such as soil activation,

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Program Element: #62704A

Title: Military Environmental Criteria Development

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

chemical fixation, and chemical neutralization/vegetative uptake, were screened for applicability. Methods for decontaminating buildings and equipment were tested. Water treatment systems were developed to remove suspended solids, organics, inorganic salts, and metals. Plans for FY 1983 include: Analytical methods are being developed for identification and quantification of eight additional chemical compounds found in soil, water, process waste disposal facilities, and biological tissue or organisms from five Army installations scheduled for contamination surveys. In addition, development of analytical methodology for detection and quantitative analysis of degradation and process byproducts from developmental decontamination processes have been initiated. In the area of Contaminant Level Criteria Development, problem definition studies, toxicity screening and follow-up toxicity studies are being continued on chemical compounds identified at installations. Five new compounds are undergoing hazard analysis; five toxicity screens and one full-scale toxicity study using vegetation, mammals, wildlife, domestic and aquatic animals are also in progress. Limited laboratory studies of in situ contaminant/treatment techniques have been initiated. Incineration methods are being tested for explosive-contaminated sediment. Water treatment studies are building upon the technical data base from ongoing comprehensive surveys. Buildings and equipment decontamination techniques are being investigated in the laboratory. Treatment systems are being field tested at two installations. Development work for treating explosive-contaminated lagoon sediment is expected to be completed. Plans for FY 1984 include: Analytical methods will be developed for the identification and quantification of eight chemical compounds found in soil, water, process waste disposal facilities and biological tissue from five Army installations scheduled for contamination surveys. Approximately six compounds will undergo hazard analysis, one toxicity screen, and one full-scale toxicity study. Preliminary design criteria for final containment or treatment measures resulting from five environmental surveys will be completed. Field and pilot water treatment studies will be conducted as input to the technology base development for contaminated installations. New decontamination techniques for chemical agent- or explosive-contaminated buildings will be piloted. In situ leaching methods to treat contaminated soil will be investigated.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62705A

Title: Electrical and Electronic Devices

DOD Mission Area: #521 — Electronics and Physical Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	15671	17675	18674	24792	Continuing	Not Applicable
AH94	Electronics and Electron Devices	15671	17675	18674	24792	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program performs exploratory development of electron devices and technology to enable the Army to meet the enemy threat with the most cost-effective technology that can be made available. The output of this program provides improvements in electron device performance needed to enhance the performance of Army equipment which uses electronic technology. Included in these developments are electronic building blocks such as custom integrated circuits which will provide improved performance; reduced cost, weight, and size; and increased reliability in such mission performance areas as electronics warfare, communications, night vision, navigation, combat surveillance and target acquisition, and missile technology. The developments of this program are directly coupled to, and driven by, Army weapon system requirements. This program is part of Major Army Technology Thrust in Very Intelligent Surveillance and Target Acquisition (VISTA).

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	15671	17675	18674	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	15275	17725	18613	Continuing	Not Applicable

Increases in FY 1982 and 1984 are due to application of updated indices for civilian labor costs. Decrease of \$50 thousand in FY 1983 is due to pro rata application of general Congressional reductions to the RDTE/A appropriation.

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Program Element: #62706A

Title: Electrical and Electronic Devices

DOD Mission Area: #521 — Electronics and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Devices and technologies developed in this program are moved into Program Element #63742 (Advanced Electronic Devices) for advanced development. Direct liaison with affected and potentially affected Army program managers is routinely maintained, as is close liaison with the research and development organizations of the Air Force and Navy. Duplication of effort is also precluded by coordination through the Department of Defense Advisory Group on Electron Devices and the Interagency Advanced Power Group.

F. (U) WORK PERFORMED BY: The Electronics Technology and Devices Laboratory (ET&DL), Fort Monmouth, New Jersey, performs over 50% of the development work under this program element.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: AH 94 — Electronics and Electron Devices

a. (U) Project Description: This project provides the prime source of funds within the Army to solve critical electronic component deficiencies and to develop new technologies and manufacturing processes to maintain the technological superiority of US forces in the field. For a number of years, the United States has relied on its superiority in electronic technology to provide a force multiplier; however, in recent years the relative gap between US and Communist Bloc technology has been narrowing. This project provides the developments necessary to ensure that newly developed weapons represent the best technology that can be afforded, and also provides the means for enhancing the performance and extending the lifetime of weapons to ensure maximum utilization of the weapons system dollar.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Completed first module of low-cost, rugged 94Ghz transceiver for guidance and radar, and demonstrated it to Project Manager, Remotely Piloted Vehicle. Continued second year of conformal millimeter wave antenna arrays for use on tanks and in munitions. Demonstrated an electronic warfare gallium arsenide time interval analyzer. Completed lightweight, low-power, sunlight-legible flat panel display and delivered to contractor for integration into digital message device. Achieved goal of twofold energy increase and reduced heat evolution in lithium thionyl chloride battery for night vision and target designation devices.

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Program Element: #62705A

Title: Electrical and Electronic Devices

DOD Mission Area: #521 — Electronics and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

(2) (U) FY 1983 Program: Will complete 94Ghz hybrid transceiver kit to fit 6-inch self-contained munitions. Initiate development of wideband integrated circuit receiver for ELINT receivers. Design early prototype ultra-high speed gallium arsenide frequency synthesizer for all digital radios and advanced Quicklook circuits. Complete and distribute Very High Speed Integrated Circuit (VHSIC)-like computer-assisted design tools to developers. Complete feasibility design of 1-meter-square, thin-film electroluminescent flat panel display and initiate fabrication. Provide lithium thionyl chloride cells for battery designs built for high safety and high performance in laser applications. Design and build an ultraviolet preionizer pulser and deliver to the Missile Command for use in a high-energy laser air defense weapons system.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Start exploratory development of 94Ghz monolithic transceivers (receiver/transmitter on-a-chip) to fit 4-inch terminal guidance submunitions and missile guidance. Demonstrate wideband coverage in a single traveling-wave tube at the 20-watt level for use in an airborne jammer. Test silicon-on-sapphire frequency synthesizer for use in SINGARS and data link equipment. Continue development on 1-meter-square flat panel display and drive electronics. Provide improved lithium thionyl chloride battery cells with moderate rate capabilities at acceptable low temperatures ready for battery designs in communications-electronics equipment where high quality, low cost, and ease of disposal are essential. Initiate development of a 1Ghz bandwidth signal processor for realtime target acquisition. Develop temperature-compensated crystal oscillator engineering models for lifetime calibration-free operation of SINGARS radios.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62706A

Title: Chemical Biological Defense and General Investigations

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	26898	28508	34833	37488	Continuing	Not Applicable
A553	Chemical/Biological (CB) Defense and General Investigations	26898	28508	34833	37488	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Soviet Union has long recognized and appreciated the ability of chemical-biological weapons to inflict casualties, degrade combat effectiveness, and disrupt the battlefield. The USSR continues to maintain and improve its formidable capability to conduct chemical-biological warfare operations. Consequently, the US military must have the capability to survive and conduct sustained operations in a chemical-biological warfare environment. Failure to correct user-identified deficiencies in chemical-biological defensive materiel and avoid technological surprise would seriously jeopardize the survivability and sustainability of US forces in the event of a chemical-biological attack. The Army has been assigned Executive Agent responsibility for conducting chemical-biological defense research and development for the Department of Defense. This program element addresses the urgent need to provide all Services with defensive materiel to protect individuals and groups from threat chemical-biological agents. The program element provides for the conduct of exploratory development for all the Services in chemical-biological individual and collective protection; reconnaissance, detection, and warning; decontamination and contamination avoidance; toxin defense; and training. The program element also provides for the conduct of special investigations into the chemistry and effects of threat agents and the analysis and integration of chemical-biological defense systems necessary to avoid technological surprise and support advanced development efforts.

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Program Element: #62706A

Title: Chemical Biological Defense and General Investigations

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	26898	28508	34833	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	22899	29589	48316	Continuing	Not Applicable

The FY 1982 increase of \$3999 thousand is a result of decisions to initiate programs in toxin defense and biotechnology and the need to conduct additional exploratory development in alternate designs and improved materials for protective masks. The initiation of the toxin defense program was a consequence of the evidence of Soviet-sponsored employment of toxins in Southeast Asia and the need to characterize this threat, assess the protection provided by current defensive materiel, and develop toxin defense systems. The biotechnology program is an attempt to exploit the advances already made in this field by private industry by applying biotechnology to solve such problems as false alarm free detection of chemical agents and reducing the logistics burden of decontamination operations. The funding decrease of \$1081 thousand in FY 1983 is the result of Congressional direction in the FY 1983 Appropriations Act and pro rata applications of general Congressional reductions to the RDTE,A appropriation. The FY 1984 decrease of \$13,483 thousand was the result of a decision to redirect these funds to other, higher priority Army programs and a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Department of Defense Directive 5160.5 assigns the Army responsibility for research, exploratory development, and advanced development in chemical-biological defense for all Services and for engineering development for the Army and for joint requirements of the Army with other Services. In order to meet other Services' needs and to prevent unnecessary duplication of effort, execution of this responsibility is coordinated through the Joint Development Objectives Guide (JDOG), joint working groups, and periodic joint reviews of the Joint Chemical-Biological Research, Development, Test, and Evaluation Program. Coordination and cooperation is maintained with allied countries via Data Exchange Agreements and with the North Atlantic Treaty Organization (NATO). Related technical investigations are conducted under Program Element #62622A (Chemical and Smoke Munitions). The technology developed under this Program Element, #62706A (Chemical Biological Defense and General Investigations), progresses into Program Elements #63721A (Chemical Biological Protective Materiel Concepts) and #63720A (Chemical/Biological Detection, Warning and Sampling Materiel Concepts).

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Program Element: #62706A

Title: Chemical Biological Defense and General Investigations

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

F. (U) **WORK PERFORMED BY:** In-house work is performed by the Army Chemical Systems Laboratory, Aberdeen Proving Ground, MD; Oak Ridge National Laboratories, Oak Ridge, TN; and US Army Natick Research and Development Laboratories, Natick, MA. Contractors include Honeywell Corporation, St. Petersburg, FL; Ash Stevens Incorporated, Detroit, MI; Batelle, Columbus, OH; Brunswick Corporation, Marion, VA; Southern Research Institute, Birmingham, AL; Mine Safety Appliance, Pittsburgh, PA; Midwest Research Institute, Kansas City, MO; Bendix Corporation, Towson, MD; and ILC, Dover, NJ.

G. (U) **PROJECTS LESS THAN \$10 MILLION IN FY 1984:** Not Applicable.

H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:**

1. (U) **Project: A553 — Chemical Biological Defense and General Investigations.**

a. (U) **Project Description:** The Soviet Union has long recognized and appreciated the ability of chemical-biological weapons to inflict casualties, degrade combat effectiveness, and disrupt the battlefield and continues to maintain and improve its formidable capability to conduct chemical-biological warfare operations. Consequently, the US military must have the capability to survive and conduct sustained operations in a chemical-biological warfare environment. This program element addresses the urgent need to provide all Services with defensive materiel to protect individuals and groups from threat chemical-biological agents. The project provides for the conduct of exploratory development for all the Services in chemical-biological individual and collective protection; reconnaissance, detection, and identification; decontamination and contamination avoidance; toxin defense; and training. The project also provides for the conduct of special investigations into the chemistry and effects of threat agents and the analysis and integration of chemical-biological defense systems necessary to avoid technological surprise and support advanced development efforts. A detailed description and program for the reconnaissance, detection, and identification technical area is provided in paragraph 2 below.

b. (U) **Program Accomplishments and Future Efforts:**

(1) (U) **FY 1982 Accomplishments:** A preliminary effort to characterize the mycotoxin threat was completed, testing of current protective equipment against T2 toxin was completed, and candidate reactions for use in a toxin detection kit were identified. A contract to develop bacteria and virus test kits for reconnaissance teams was awarded. Multiyear contracts to develop infrared and ultraviolet technology remote Nuclear-Biological-Chemical (NBC) detectors and a contract to develop a chemical dosimeter were awarded. The NBC reconnaissance vehicle exploratory development effort was continued. An evaluation of the effectiveness of standard and developmental filter canisters against known filter-penetrating chemical agents was initiated, contracts were awarded for prototype definition of a high-performance aircrew protective mask and power respirator, and the

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Program Element: #62706A

Title: Chemical Biological Defense and General Investigations

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

development of conceptual models of alternate design follow-on protective masks to replace to the M17 series mask were completed. A series of handbooks for weapon system developers on designing to minimize the effects of contamination was completed. A program to apply biotechnology, one of the Army thrusts, to the problem of chemical detection and identification was initiated.

(2) (U) FY 1983 Program: The characterization of the toxin threat will be expanded to include marine toxins, developmental protective equipment will be tested against mycotoxins, and development of a toxin detection kit will be initiated. Feasibility testing of the bacteria and virus test kits will be conducted, and development of a rickettsia test kit will be initiated. Breadboard models of the infrared and ultraviolet NBC remote detectors will be completed. Exploratory development of the basic NBC reconnaissance vehicle will be completed. Development of a chemical dosimeter will be continued. Development of a chemical on-line water monitoring system to monitor for the presence of chemical agents in water purification systems will be initiated. Alternate, agent-resistant materials will be investigated as a liner for the Advanced Simplified Collective Protection System. Development of lightweight throwaway covers to protect equipment from liquid contamination will be initiated. The monitoring of advances by private industry in biotechnology and the investigation of the use of biotechnology techniques, specifically monoclonal antibodies, to detect and identify chemical agents will be continued. As a result of Congressional action with respect to the FY 1983 appropriation, planned FY 1983 efforts to explore other biotechnology techniques for chemical detection and the application of biotechnology to decontamination will be deferred to FY 1984. The evaluation of alternate design follow-on protective masks will be completed.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: The characterization of the toxin threat will be expanded to include plant toxins and venoms, a feasibility demonstration of a toxin detection kit will be conducted, and exploratory development of an automatic toxin detector will be initiated. Exploratory development of the bacteria and virus test kits will be completed, and development of a rickettsia test kit will be continued. Testing of the breadboard infrared and ultraviolet NBC remote detectors will be conducted. Efforts to integrate biological agent detection and NBC remote detection capabilities into the NBC reconnaissance vehicle will be continued. Development of the chemical on-line water monitoring system will be continued and development of an in-mask leak detector will be initiated. The investigation of alternate, agent-resistant materials as a liner for the Advanced Simplified Collective Protection System will be completed. Development of lightweight throwaway covers to protect equipment from liquid contamination will be continued. Efforts to exploit recent advances in biotechnology will continue. The biotechnology program will continue to monitor developments by private industry and continue the use of monoclonal antibodies for chemical detection and warning and will begin the exploration of other biotechnology techniques for chemical detection and the application of biotechnology to decontamination.

(4) (U) Program to Completion: This is a continuing program.

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Program Element: #62706A

Title: Chemical Biological Defense and General Investigations

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

c. (U) Major Milestones: Not Applicable.

2. (U) Technical Area: A553-C Reconnaissance, Detection and Identification.

a. (U) Technical Area Description: This technical area serves to develop new and improved concepts for reconnaissance, detection, warning, and identification of threat chemical, toxin, and biological agents; to develop battlefield contamination display and NBC sensor intelligence transmission systems; to increase sensitivity, specificity, and ease of use; to decrease the logistics burden; and to minimize the number of detectors in the field. This technical area responds to the requirements of the Air Force, Navy, Marine, and Army as well as interfacing with similar efforts of allied nations.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: A tandem mass spectrometer (MS/MS) was purchased and installed and was thoroughly evaluated for sensitivity and specificity as an agent detector. Studies were initiated to reduce the size, weight, and power requirements of the device. A sampling probe was fabricated for the mass spectrometer using information obtained from a NATO ally under a data exchange agreement. An articulating arm was designed, fabricated, and mounted on a testbed vehicle to determine its utility in taking surface samples at a distance from the NBC Reconnaissance Vehicle so that the operator need not exit the vehicle. In the attempt to increase the sensitivity of the chemical water test kit, an enzyme system using eel cholinesterase was found to demonstrate the required sensitivity, and storage stability studies were initiated. Several compounds were synthesized for the direct detection of mustard agent, but failed to have the required sensitivity. Efforts are underway to correct this problem and to accelerate the reaction. Efforts were initiated to determine the selective permeation of polymeric materials and isolate specific sorbent materials for use with detectors and/or dosimeters. Efforts were initiated to expand the technology base in infrared and ultraviolet technology for the detection and identification of chemical agents. A multiyear effort to develop new remote sensing concepts was initiated. Definition of design characteristics and trade-offs for an NBC Ground Reconnaissance System and an NBC Aerial Reconnaissance System was initiated. Fundamental studies on new electro-optical techniques/systems applicable to agent detection/identification, an effort to exploit the potential of a portable mass spectrometer, and efforts on a Personal Automatic Liquid Agent Detector (PALAD) and an Individual Chemical Alarm/Dosimeter were initiated.

(2) (U) FY 1983 Program: The evaluation of and concept feasibility studies on sensors, sampling devices, and other components using the NBC reconnaissance testbed will be completed, the most effective/efficient sensor for further studies in the AD phase will be selected, and the approach for sampling and detecting biological agents will be selected. Efforts to develop concepts for a chemical dosimeter will continue. Studies on instrumentation for on-line monitoring and quantitative determination of all threat agents in water will be initiated. Infrared NBC Remote Sensing

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Budget Activity: #1 — Technology Base

concept and ultraviolet NBC Remote Sensing concept breadboard models will be built. Studies to define the relationship of surface agent effluents to the actual hazard to man will be initiated. Personal liquid/vapor alarms and dosimeters concepts will be evaluated. Studies on new NBC warning and alarm concepts will continue.

(3) (U) **FY 1984 Planned Program and Basis for Budget Year Request:** Efforts to integrate biological agent detection and NBC remote detection capabilities into the NBC reconnaissance vehicle will be continued. These efforts support the program to field an integrated chemical-biological (CB) reconnaissance system capable of detecting, identifying, quantifying, and mapping CB contamination from the air and ground. Development of a chemical dosimeter to quantify the total amount of chemical agent an individual has been exposed to will be continued. Efforts will concentrate on providing increased sensitivity to detect low exposure levels at which miosis occurs. The dosimeter will provide a means of monitoring the condition of individuals such as pilots where low exposure levels will result in an unacceptable degradation of performance. The development of a chemical on-line water monitoring system to monitor for the presence of chemical agents in water purification systems and water sources will be continued. This system will be used by medical and engineer personnel to check for ultra-low levels of threat chemical agents in drinking water supply sources. A program to develop a leak detector to be placed inside the protective mask will be initiated. This device will give a simple go-no-go indication of filter saturation or periphery leakage and prevent continued exposure to low concentrations of toxic chemical agents. Functional tests will be conducted using the infrared and ultraviolet NBC Remote Sensor breadboard models built in FY 1983. These tests will demonstrate the technologies being developed for NBC remote sensing. The NBC Remote Sensor will provide a standoff capability of detecting and identifying NBC agents and will be employed in air and ground NBC reconnaissance systems. The ongoing study of chemical contact hazards will continue. This study addresses the hazard resulting from liquid chemical agents being absorbed by plastics, rubber, and painted surfaces. Even after the obvious liquid contamination is gone, the chemical agent continues to be given off by the contaminated surface. This study addresses the conditions under which this constitutes a hazard to man and will also support the design of a surface contamination monitor probe to be initiated in FY 1984. The probe will provide an attachment for a chemical agent alarm to test for the presence of surface contamination which poses a contact hazard. Development of a chemical munitions leak detector will be initiated in FY 1984. The munitions leak detector will be a simple detection device to be placed in chemical munition depots and storage sites to detect leaking munitions.

(4) (U) **Program to Completion:** This is a continuing program.

c. (U) **Major Milestones:** Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62707A

Title: Mapping and Geodesy

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	5710	6382	8336	9051	Continuing	Not Applicable
A855	Mapping and Geodesy Topographic/Geodetic Technology	5710	6382	8336	9051	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Army and DOD tactical operations and strategic planning require rapid access to precise position, azimuth, elevation, and descriptive terrain information. The Mapping and Geodesy Program investigates and demonstrates feasibility of responsive and cost-effective methods and equipment for collecting, processing, displaying, and disseminating geodetic, topographic, and military geographic data and products.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	5710	6382	8336	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5750	6830	8962	Continuing	Not Applicable

In FY 1982, a \$40,000 decrease resulted from reprogramming of funds to higher priority Army programs. In FY 1983, a decrease of \$448,000 is a result of Congressional direction in the FY 1983 Appropriations Act and reprogramming of funds for the High Technology Light Division. In FY 1984, a decrease of \$626,000 has been imposed to meet the funding needs of higher priority Army programs.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

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Program Element: #62707A

Title: Mapping and Geodesy

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

E. (U) RELATED ACTIVITIES: This program element applies results of basic research performed under Program Element #61102A (Defense Research Sciences), Project #B52C (Mapping and Geodetic Research). Both the Air Force and Navy have related mission-oriented research, which is coordinated with the Army's program by the Defense Mapping Agency (DMA) and the Under Secretary of Defense for Research and Engineering (USDRE). Advanced and engineering development of techniques and equipment resulting from this program is accomplished under the following program elements: DMA Program Element #63701B (Mapping, Charting, and Geodesy Investigation and Prototype Development); Army Program Element #63712A (Mapping and Geodesy); DMA Program Element #64701B (Mapping, Charting, and Geodesy Engineering Development and Test); and Army Program Element #64716A (Mapping and Geodesy). There is no unnecessary duplication of effort within the Army or the Department of Defense related to this program element. Duplication of effort is avoided by annual DOD Apportionment and Budget Reviews, DMA Technology Base Reviews, periodic DOD Topical Reviews, and technical coordination within Army and among the Service research laboratories.

F. (U) WORK PERFORMED BY: Approximately 65% of the work is performed in-house at the US Army Engineer Topographic Laboratories, Ft. Belvoir, VA. The balance is performed by commercial contractors or other Government agencies. The major contractors are: Decilog, Inc., Melville, NY; Helava Associates, Southfield, MI; ITT Research Institute, Chicago, IL; SRI, Menlo Park, CA; and General Electric Space Division, Philadelphia, PA. There are 12 other contractors involved in a total FY 1983 contract program totaling \$1,900,000.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: A855 — Mapping and Geodesy Topographic/Geodetic Technology: Army and DOD tactical operations and strategic planning require rapid access to precise position, azimuth, elevation, and descriptive terrain data. This project develops feasible approaches for providing responsive and cost effective methods and equipment for collecting, processing, displaying, and disseminating geodetic, topographic, and military geographic data and products. During FY 1982, the Field Exploitation of Elevation Data System was demonstrated in various military exercises including Bold Eagle. The system was transferred to the XVIII Airborne Corps for additional operational testing. The Terrain Analysis Synthesizer was transferred to the 29th Engineer Topographic Battalion for further field tests and evaluation. Various Terrain Analysis Procedure Guides including Obstacle Siting and Water Resources were completed. Voice recognition and synthesis for data display control was installed on two in-house experimental systems to enhance the artificial intelligence-robotics efforts. A study entitled "Predicting Likely Minefield Sites Using Terrain Analysis" was completed, and the resulting techniques will be tested in the field in Europe. A development plan for a Robotics-Reconnaissance Vehicle Demonstrator was completed including planned Advanced Development in FY 1984-1985. In FY 1983, a system integration study has been initiated for the Reconnaissance Vehicle Demonstrator. Software and data base validation for the mobility and intervisibility models are being completed for incorporation in the Digital Topographic Support Systems. Preliminary specifications for a common weapons Direction Reference Unit for use by all Army weapons are being drafted and coordinated. Topographic Support Systems model simulation is being completed. In FY 1984, contour manipulation and stereo overlay editing software will be completed. The final group of a series of Procedural Guides for Terrain Analyst will be

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Program Element: #62707A

Title: Mapping and Geodesy

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

published and distributed for use in field activities. System design of a fieldable Multi-Spectral Automated Photo Interpretation device will be completed. Rule-based Photointerpretation Logic networks will be prepared for experimentation in artificial intelligence. The system integration study for the Reconnaissance Vehicle Demonstrator will be completed and prepared for initiation of advanced development.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62709A

Title: Night Vision Investigations

DOD Mission Area: #521 — Electronic and Physical Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	11472	13561	19942	23580	Continuing	Not Applicable
DH95	Night Vision Investigations	11472	13561	19942	23580	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Army has a need for a cost-effective means to fight during periods of darkness and limited visibility with a relative combat capability that is equal to that of day. This program element supports the development of technology to ensure the United States (US) maintains its lead in the ability to acquire and engage targets under all battlefield conditions. This combat capability is required to counter the threat of a foe who plans and trains to continue combat operations during periods of darkness and limited visibility. Using advanced technologies and new concepts in the field of electro-optics, this program develops new techniques, components, and devices that will result in significant cost reductions and performance improvements for night vision devices. This program element contributes directly to major Army technology thrusts in Very Intelligent Surveillance and Target Acquisition (VISTA) and Self-Contained Munitions.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	11472	13561	19942	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	13154	14101	13934	Continuing	Not Applicable

Decrease in FY 1982 was due to program realignment and reprogramming to higher priority projects. The decrease in FY 1983 (\$540 thousand) was due to reprogramming to the High Technology Light Division and pro rata application of general Congressional reductions to the RDTE, A appropriation. The estimated increase in funding from \$13934 thousand to \$19942 thousand in FY 1984 reflects the emphasis in component development to design — in low cost and high reliability before transition to advanced development.

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Program Element: #62709A

Title: Night Vision Investigations

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Research work related to this project is performed under Program Element #61102A (Defense Research Sciences), Project #A31B (Night Vision and Electro-Optics Research). Advanced development work is performed under Program Element #63710A (Night Vision Advanced Development). Close coordination is maintained with the different Army project managers' offices and commodity commands in order to have complementing efforts while avoiding duplication. Close coordination is maintained with the Navy, Air Force, and Marine Corps to avoid duplication in component developments and evaluation. Through the Joint Logistics Commanders, panels have been established to coordinate all night vision technology programs and ensure that maximum use is made of limited assets. The Joint Deputies for laboratories Sub-Panel on Night Vision Technology, with representatives from all Services and the Defense Advanced Research Projects Agency (DARPA), annually reviews the activities in key technology areas and reports their findings on program gaps and overlap. The FY 1982 annual report shows no unnecessary duplication of effort within the Army or Department of Defense. In addition, an active international program of technical cooperation is maintained with several countries, particularly those of the North Atlantic Treaty Organization (NATO) and the Quadripartite Countries (America, Britain, Canada, and Australia).

F. (U) WORK PERFORMED BY: Night Vision and Electric-Optics Laboratory, Fort Belvoir, VA. Representative contractors are: Honeywell Electro-Optics Operations, Lexington, MA; Martin Marietta, Orlando, FL; Hughes Aircraft, El Segundo, CA; and Texas Instruments, Dallas, TX.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: DH95 — Night Vision Investigations

a. (U) Project Description: The total effort covers exploratory development of components, techniques, man/machine models, smart sensor models, and environmental data bases essential for both significant cost reductions and performance improvements in night electro-optical devices. The visionics program is concerned with development of system performance models, acquisition of data bases for target signatures, and establishment of new techniques for specification of advanced sensors. Computer models are used to simulate the performance of both man-in-the-loop and autonomous sensors of the active battlefield. Results of analytic studies on sensor performance are used to guide new sensor designs and recommend areas of highest payoff of research and development investment for the Army in future sensor development. Far infrared thermal imaging technology is directed toward fabrication and initial testing of second-generation Forward Looking Infrared (FLIR) imagers. A new generation of high-performance IR sensors is being developed which uses high-density, Charge-Coupled Devices (CCD) focal plane arrays (FPA). This FPA sensor will double the standoff range of present FLIRs in airborne applications and greatly enhance the performance of combat vehicle FLIR under conditions of

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Program Element: #62709A

Title: Night Vision Investigations

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

poor visibility. In addition, the imaging focal plane array, in conjunction with smart signal processing on a missile seeker, will permit "fire and forget" operation of future airborne and ground-launched tactical missiles. Increased search effectiveness is aided by automatic target cueing and image enhancement techniques. Large two-dimensional staring focal plane arrays which use CCD signal processing to electronically scan the detector array offer significantly improved system sensitivity while greatly reducing the system's mechanical and optical complexity. For Lasers, the concept of a "common module" carbon dioxide laser and definition of a family of compact modular elements compatible with FLIR is being developed. Applications of this laser family include identification friend or foe, beamrider missile guidance, target designators, and wind sensors. Laser common modules and interface elements for interaction with a FLIR are being constructed and tested. Optical countermeasures are being developed to deny the enemy use of target acquisition and engagement systems. Because of the noncommercial aspects of night vision and electro-optical technologies, it is essential to maintain an internal research and development activity.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: In the visionics area, a major field exercise was conducted in Germany to evaluate image intensifiers and thermal imaging in navigation roles. The Visionics Handbook of Electro-Optical sensor performance for all deployed Army systems in natural European environments was distributed throughout the Army. In thermal imaging, designs were completed and hardware initiated for a high-density focal plane detector array which would be common to both second-generation infrared imaging systems and "fire-and-forget" missile seekers. Improvements in detector fabrication technology were incorporated to increase yield of these devices. In lasers, the carbon dioxide (CO₂) laser sensor hardware for a heterodyne all-weather target acquisition and engagement system was demonstrated. Also demonstrated was a high-peak-power solid state laser as primary driver for an optical countermeasure system.

(2) (U) FY 1983 Program: The visionics technology is being reoriented towards understanding and describing smart sensors. New analytic models for target cuers, trackers, and recognizers are being developed along with new bench evaluation techniques for testing and specifying such devices. High dynamic range digital target signature imagery is being obtained for algorithm development and evaluation. Under the thermal imaging program the first high-density focal plane array (FPA) is being developed and evaluated for feasibility as an imaging sensor in the Joint Services Missile Seeker. Also, based on prior successful research, development has accelerated on a new concept in thermal imaging which uses an uncooled staring FPA to greatly simplify the peripheral mechanical hardware. Work continues in the development of high-efficiency solid state lasers for optical countermeasures. A CO₂ laser-radar is being integrated with a signal processor and tested for automatic target acquisition and engagement.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: In the visionics area, a Government/industry standard digital data base of target signatures will be assembled and operational. An advanced sensor evaluation facility will be completed, and evaluation of autonomous trackers and target cuers will begin. Volume II of the Visionics Handbook for advanced sensors and time-dependent target acquisition will be

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Program Element: #62709A

Title: Night Vision Investigations

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

prepared and published. In the area of thermal imaging the focal plane array (FPA) sensor for both missile seeker and second-generation imaging systems will undergo a complete evaluation under simulated stress conditions in preparation for transition to advanced development. Low-cost methods for FPA packaging and testing will be established in order to insure affordability of future sensors, especially in "fire and forget" missiles. Development will continue on the uncooled FPA for applications where very low cost and small size are required features and moderate performance is acceptable. Under the laser program, development will continue on CO₂ laser "Common Module" components for all-weather target acquisition, rangefinding, and designating. Advanced laser sources for future optical countermeasure systems will be evaluated.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62715A

Title: Tactical Electronic Warfare Technology

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	8226	10617			Continuing	Not Applicable
A042	Tactical Electronic Warfare Techniques	5226	6588			Continuing	Not Applicable
A904	Tactical Electronic Warfare and Intelligence Techniques	3000	4029			Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supplies the exploratory development technology in support of all Army Electronic Warfare (EW) programs. The effective use of EW will be one of the most important combat multipliers on the modern battlefield. The ability to reduce the enemy's command and control by disrupting his communications and to protect our forces from detection and radar, electro-optical, and infrared guided weapons may spell the difference between victory and defeat in any future conflict. The efforts of this program are coordinated with the intelligence community to identify foreign technological advancements and develop countermeasures to these advancements. The rapidly increasing use of precision-guided weapons necessitates a corresponding effort in the detection and countering of such threats. Investigation and development is continuing to insure that the latest developmental US missiles, communications, electronics, and night vision systems will function satisfactorily in a hostile countermeasures environment.

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Program Element: #62715A

Title: Tactical Electronic Warfare Technology

DOD Mission Area: #521 — Electronic and Physical Sciences (ED)

Budget Activity: #1 — Technology Base

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	8226	10617		Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	9707	10646		Continuing	Not Applicable

Decrease in FY 1982 due to reprogramming to higher priority Army programs. Decrease in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTEA appropriation. Decrease in FY 1984 due to reprogramming to projects developing technology in the Very Intelligent Surveillance and Target Acquisition area.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This work is in direct support of program elements #63745A (Tactical ESM Systems), #63755A (Tactical ECM Systems), #64745A (Tactical ESM Systems), and #64750A (Tactical ECM Systems). Work on the development of electronic counter-countermeasures (ECCM) technology supports numerous Army electronics systems in the area of communications and noncommunications. Tri-Service technical efforts in electronic warfare receive extensive review as a result of participating in Joint-Service Technical Programs, Electronic Counter-Countermeasure Workshops, and Joint Technical Coordinating Groups which reduce duplication among the Services. Coordination is also furthered through tri-Service preparation of a Technology Coordinating Paper on Electronics and the annual reviews by the Under Secretary of Defense for Research and Engineering (USDRE). Ongoing efforts in this line have been identified to support the Very Intelligent Surveillance and Target Acquisition Test Bed when it is established.

F. (U) WORK PERFORMED BY: The US Army Electronics Research and Development Command (ERADCOM), Adelphi, MD, consisting of the Electronic Warfare Laboratory (EWL), Fort Monmouth, NJ; US Army Signals Warfare Laboratory (SWL), Warrenton, VA; Office of Missile Electronic Warfare (OMEW), White Sands Missile Range (WSMR), NM; Harry Diamond Laboratories (HDL), Adelphi, MD; and Electronics Technology and Devices Laboratory (ETDL), Fort Monmouth, NJ. Supporting efforts are provided by the Lettner Research Institute, San Francisco, CA; Naval Weapons Center, China Lake, CA; Pacific Missile Test Center, Point Mugu, CA; Air Force Avionics Laboratory, Wright Patterson Air Force Base, OH; and Rome Air Development Center, Griffiss AFB, NY. The top five contractors are RCA Corporation, Princeton, NJ; Sanders Associates, Nashua, NH; Hazeltine

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Program Element: #62715A

Title: Tactical Electronic Warfare Technology

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

Corp., Greenlawn, NY; Parkin-Elmer Corp., Wilton, CT; and Scientific Technical Associates, Arlington, VA. There are 36 other contractors with a total contract value of \$3207 thousand.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) **A042 — Tactical Electronic Warfare Techniques:** The FY 1982 program consisted of survivability developments including the initiation of, upgrading of in generic simulations, and completion of jamming analysis and field tests. In the signals analysis area, the high-speed sorter was demonstrated, and developments of a monolithic direction-finding receiver and were initiated. In the vulnerability reduction area, development of multichannel and high-frequency steerable null antenna processors to protect radio systems against jamming were started, and an initial chaff data base was established. In the jamming area, a concept demonstration was done using the Navy-developed ALQ-99 radar jammer mounted in a UH-1 helicopter, and a development was started to. In FY 1983 survivability developments will consist of a brassboard to, evaluation of countermeasures that may be possible against missiles and test and evaluation of a laser warning receiver. In the surveillance area, a precision signal processor will be developed, a direction-finding receiver in the will be tested, and a direction-finding antenna/receiver in the will be developed. In the vulnerability area, the steerable-null antenna processors will be tested, and validation will be done on the Jamming developments will include airborne radar jamming simulation and analysis, development of a array antenna and testing of the FY 1984 will include testing of the and brassboard development of an electronically modulated jammer and target identification subsystem. The direction-finding antenna/receiver modules will be tested as well as simulation testing of the emitter identification processor. The steerable null antenna processors will be analyzed for transition to full-scale development as improvements to existing radio systems, and the chaff data base will be updated. Finally, in the jamming area, development will begin on high-power millimeter wave, electronically steered antennas, high-power jammer management modules, and a remote

2. (U) **A904 — Tactical Electronic Warfare and Intelligence Techniques:** The FY 1982 program tested a prototype distributed signal processor in the GUARDRAIL airborne collection system and completed microcode software and bit-slice hardware board layout for GUARDRAIL. Jamming techniques against were identified, and two signal collection and processing systems developed by the Air Force were delivered to the Signals Warfare Laboratory. Signals collection with these systems was conducted during FY 1982. A technical analysis of 43 unmanned aerial vehicle antenna types was conducted, and prototype development was started on two alternative techniques for efficient, high-power communications amplifiers. Enhancements were made to antenna, seeker, and signal processor subsystems designed for use on drones. The FY 1983 program will begin development of multiple distributed signal processing interfaces, complete a preliminary very high speed integrated circuit insertion plan and identify software signal processing algorithms that require development. Development of jamming techniques will continue and development of jamming techniques will begin. High-power transmitter developments will emphasize development of a field effect transistor and a quick-tune amplifier. Development will start on a antenna. Improvements in signal processing and antenna/seeker frequency range for drone applications will be developed. The FY 1984 program will design a 32-bit microprocessor subsystem and test brassboard very high speed integrated circuit processors. The

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Program Element: #62715A

Title: Tactical Electronic Warfare Technology

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

distributed signal processing interface will be completed, and new software algorithms will be developed and tested. The developments to attack The high-power transmitter developments will be completed and selection will be made of the transistor type for powers greater than Directive jamming antennas for airborne jammers will be started, and the frequency range of the unmanned aerial vehicle antenna will be extended to The accuracy and sensitivity of existing seekers will be improved, and software algorithms to process new signals and modulations will be designed.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62716A

Title: Human Factors Engineering System Development

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	8547	9052	11226	12170	Continuing	Not Applicable
AH70	Human Factors Engineering System Development	8547	9052	11226	12170	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program, which supports the Army's major technology thrust in Soldier-Machine Interface, ensures that Army materiel can be effectively operated and maintained by the soldier in the field. The program generates human factors data and provides it to Army materiel developers. Results of this work: improve US Army artillery system effectiveness in combat; increase the US Army's ability to fight in builtup areas; improve the individual soldier's personal equipment and its compatibility with other items (weapons, protective mask, load-carrying equipment, and armored vest); reduce noise damage to hearing of military personnel; improve performance of individual and crew-served weapon systems, improve development of visual displays for future Army air defense systems; reduce air-crew workload imposed by the introduction of new electronic displays; improve controls and data processing equipment in Army helicopters; improve ammunition resupply procedures; ensure effective soldier integration into command, control, and communication nets; reduce manpower requirements and enhance performance through the use of artificial intelligence/robotics.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	8547	9052	11226	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	8547	9173	11409	Continuing	Not Applicable

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Program Element: #62716A

Title: Human Factors Engineering System Development

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

The funding decrease of \$121 thousand in FY 1983 is a result of reprogramming of \$95 thousand for the High Technology Light Division and \$26 thousand as a pro rata application of general Congressional reductions to the RDTE,A appropriation. The funding decrease of \$183 thousand in FY 1984 resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The Human Engineering Laboratory (HEL) is a leader in tri-Service coordination through a tri-Service Human Factors Technology Coordination Group. The HEL chairs or participates in a helicopter human factors engineering subcommittee and a human factors test and evaluation subcommittee; assembles all appropriate data and publishes all tri-Service human factors engineering design standards and human factors engineering design handbooks. In addition, the HEL chairs two NATO research and development committees. HEL performs an independent human factors engineering review of all major Army materiel systems which require biomedical, safety, operational and development testing input. Efforts described above help to eliminate duplication of efforts within the Army and the Department of Defense.

F. (U) WORK PERFORMED BY: In-house work is performed by the US Army Human Engineering Laboratory, Aberdeen Proving Ground, MD. The top five contractors are: Armament Systems Inc (ASI), Anaheim, CA; AAI Corporation, Baltimore, MD; Food Machinery Corp, San Jose, CA; Essex Corporation, Alexandria, VA; and Abbott Associates, Rockville, MD. In addition to the five major contractors, a total of \$917,316 was distributed to five other commercial concerns in FY 1982.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: AH70 — Human Factors Engineering System Development.

a. (U) Project Description: This project generates data on soldier-system interfaces, soldier-system performance, and the capabilities and limitations of soldiers. It provides for the application of these data throughout the Army materiel development process. Human Engineering does not produce products per se, but instead acquires human performance data and provides design guidance for all types of equipment that is worn, operated, or maintained by soldiers. Specific and precise information is urgently needed on the soldier's physical and psychological capabilities and limitations so that Army materiel systems will be designed for maximum field effectiveness in the hands of the soldier. This is increasingly more important as weapon systems and materiel become more sophisticated.

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Program Element: #62716A

Title: Human Factors Engineering System Development

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

b. (U) Program Accomplishments and Future Efforts:

(1) (U) **FY 1982 Accomplishments:** Design has been completed for a robotic loader for the 8-inch howitzer, and all major system components are being assembled. "HELBAT 8," a field evaluation of command, control, and communication (C³) for field artillery, was completed, providing an assessment of artillery's ability to deliver timely, effective fire in a mobile battlefield using "move-and-shoot" tactics through improved digital C³ techniques and material in support of Advanced Field Artillery Tactical Data System and Direct Support Weapons System. Baseline data collection on maneuver C³ was completed; these data provide a baseline from which to develop a totally integrated maneuver/fire support C³ system. A fire support simulation facility was established and demonstrated. Forward Area Rearm Point (FARP) logistics support analyses were completed, and a computer model was developed to measure logistical cost associated with various FARP strategies and how helicopter effectiveness is changed as logistical costs are varied. Over 2500 human factors engineering (HFE) design inputs were made to materiel under development. Over 350 contracts were reviewed for HFE considerations as were 40 materiel requirement documents. Six source selection evaluation boards were supported, and formal HFE Analyses were performed for four major Army systems.

(2) (U) **FY 1983 Program:** Develop baseline data on human performance parameters of manual air defense command and control system. Demonstrate the ability of robotic materiel-handling equipment to rapidly strip containers and trailers of their cargo in a field Ammunition Supply Point environment. This effort has broad logistics applications beyond ammunition handling. System components of the robotic howitzer loader will be integrated, and software will be developed. New research efforts on the operational implications of a new Military Standard will begin with examination of the reliability of protective devices and their effect on soldiers' performance. A rapid test of protector effectiveness will be developed for field use as will a vocal communication test for realistic situations. The artillery simulation facility will be used to evaluate hardware, doctrine, and procedures for artillery fire support control. Efforts will include evaluations of soldier-machine interfaces, information requirements at various organizational levels, and speed and reliability of message transmission. Other research will extend the application of the weapon effects data to forecast the effects of weapons in Military Operations in Urban Terrain (MOUT).

(3) (U) **FY 1984 Planned Program and Basis for Budget Year Request:** Develop aircrew performance criteria for use in the design of multifunction controls and displays in Army helicopters. Under a Battlefield Robotic Ammunition Supply System (BRASS) concept, develop and exploit technology areas of ammunition packing, handling, and transportation. The advanced phase of the robotic howitzer loader project will be demonstrated in the fall of 1984. The potential of sensor-equipped robotic systems for replacement/augmentation of soldiers in complex tasks (depalletizing ammunition, refueling vehicles, etc.) will be explored in this demonstration. The artillery simulation facility will be used to further define the quantity, type, and format of data required at each node of the artillery fire support system to optimize effectiveness without overloading. A testbed aircraft with fully integrated target acquisition, location, and communications will be used to define the requirements of air observer crews. Continue field testing to improve soldier uniforms fabricated from high-technology materials that integrate chemical-biological protection into the basic film structure. Work on

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Program Element: #62716A

Title: Human Factors Engineering System Development

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

smoke, flame, and chemicals in Military Operations in Urban Terrain (MOUT) will be continued in both simulated and live firing experiments with particular attention to flame induced by incendiary rounds. Assess tank gunnery performance as a function of selected basic fire control elements using the tank fire control research system and scaled tactical armor range. Human engineering evaluations will be conducted with current and proposed Army communication equipment to devise changes at the soldier-system interface to improve mobility and communication system overall performance. These data will improve current capabilities and provide the data base for future Army communications equipment design.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62717A

Title: Human Performance Effectiveness and Simulations

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	3348	3571	4496	5126	Continuing	Not Applicable
A790	Human Performance Effectiveness and Simulation	3348	3571	4496	5126	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Research conducted under this program supports the Human Factors Congressional category and examines the influence human factors considerations have on improving performance. The weapons systems of the future and the supporting automated command, control, communication, and intelligence (C³I) systems are becoming more sophisticated and demand performance of more complex tasks by soldier operators and maintenance personnel. Research is needed to determine the human factors parameters which can influence system design to facilitate human performance through improvements in the soldier-system interface. There also must be research to provide a human factors basis for the design of simulators and training devices to support training for emerging systems that will minimize the use of costly operational equipment. Finally, there is a need for inclusion of human performance parameters in land combat models. Results of research conducted under this program element will provide an empirical basis for Advanced Development applications.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	3348	3571	4496	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	3373	3581	4369	Continuing	Not Applicable

Reduction of \$25 thousand in the FY 1982 funding level is a result of reprogramming to higher priority Army requirements. The funding decrease of \$10 thousand in FY 1983 is a result of a pro rata application of general Congressional reductions to the RDTE,A appropriation. The funding increase of \$127 thousand in FY 1984 is due to a realignment of program objectives.

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Program Element: #62717A

Title: Human Performance Effectiveness and Simulations

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Results of human performance research from this program move to Advanced Development under Program Element/Project 63739A (Human Factors in Training and Operational Effectiveness); results of simulator and training device research from this program move to Advanced Development under Program Element/Project 63744A (Training Simulation). Duplication of effort is avoided through Army-level and Department of Defense-level reviews, participation on the DOD Human Factors Technology Coordination Group, and DOD/National Aeronautics and Space Administration (NASA) Simulation Technology Coordination Panel. This research is coordinated directly with other Service organizations, including the Air Force Human Resources Laboratory (AFHRL), the Naval Personnel Research and Development Center (NPRDC), the Army Project Manager for Training Devices (PM TRADE), the Army Human Engineering Laboratory (HEL), and the Naval Training Equipment Center (NTEC). Memorandums of Understanding, which are jointly signed agreements of how research will be applied by operational Army users, exist between the US Army Institute for the Behavioral and Social Sciences (ARI) and the US Army Training Support Center, the US Army Test and Evaluation Command, the US Army Depot System Command, and others.

F. (U) WORK PERFORMED BY: (Primary Contractors) Human Resources Research Organization, Alexandria, VA; Decisions and Designs, Inc., McLean, VA; Litton Systems, Inc., Sunnyvale, CA; Pritsker and Associates, Inc., West Lafayette, IN; and Vector Research, Inc., Ann Arbor, MI. There are four additional contractors with contracts totaling \$107,000. The Army developing organization responsible for this program is the US Army Research Institute for the Behavioral and Social Sciences (ARI).

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: A790 — Human Performance Effectiveness and Simulation: The objective of this research is to increase the effectiveness of human performance in new, more sophisticated weapon systems and supporting command and control systems. As part of the Army's major technology thrust in Soldier-Machine Interface, this research is required in support of manned systems design that will provide an empirical base for subsequent Advanced Development applications. There is a need to measure the contribution of the human to system effectiveness. The selection of appropriate criteria for predicting effectiveness prior to system engineering must be sufficiently straightforward and reliable so they can be used to provide decisionmaking information to the Army Systems Acquisition Review Council. The dynamics of the battlefield require that weapon systems be effectively employed singly and collectively, in concert with other weapon systems in combined arms operations. Computer-based land combat models are used to gain an understanding of how various weapon systems can be combined in tactical operations to obtain maximum benefits from the special capabilities of each type of weapon system. This effort will determine the role of the human operator and design that role into these models. Research objectives are: to develop procedures for measuring and evaluating the contribution of the human to system effectiveness, to establish procedures to transform data on task performance requirements into system and training equipment design characteristics, and to determine those human performance parameters which are relevant to the design of improved combat simulation computer models and then to evaluate the impact of including human performance parameters on model validity. Project accomplishments in FY 1982

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Program Element: #62717A

Title: Human Performance Effectiveness and Simulations

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

include: development of a preliminary aptitude/ability assessment technique to include human aspects in systems design, methods for interpretation of spatial displays for improved soldier-computer interaction, interactive graphic aids for battlefield intelligence analysis, an audio-visual system for assessing command group performance during simulated exercises, techniques for assessing trade-offs between soldier skills and system design of tactical data systems. Milestones to be accomplished in FY 1983 include: determination of human, procedural, and system factors which degrade or facilitate human judgment and decisionmaking in complex battlefield situations, validate program of instruction for alternative aviation training to reduce fuel use, examine current and developing systems to incorporate human factors considerations into design requirements, assess impact of automation on system performance, and provide design requirements for Army maintenance simulators. FY 1984 milestones include: development of preliminary procedures for translating design concepts into soldier skill requirements, guidelines for the design of job aids for lower aptitude personnel, development of generalized operator models for advanced weapon systems, development of human decisionmaking models for advanced command and control systems, development of models of human performance in extended operations, guidelines for application of advanced information technology (e.g., microprocessors) for improved simulators and training devices, and development of guidelines for improved maintenance simulation training.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62719A

Title: Mobility and Weapons Effects Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	8226	7479	8918	9330	Continuing	Not Applicable
AT4O	Mobility and Weapons Effects Technology	8226	7479	8918	9330	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The potential for fighting a numerically superior, modern, mechanized opponent in a European or Southwest Asian environment requires that the effectiveness of the combat engineer be significantly increased. Exploratory development in military engineering will increase the effective employment and survivability of the Army's sophisticated weapons systems by: (1) providing ground mobility/countermobility technology to exploit the best killing characteristics of our new weapons and insure that battlefield terrain is used effectively as a force multiplier; (2) providing techniques for rapid repair of battle-damaged facilities and construction in support of combat and logistical elements in the theater of operations; (3) increasing our knowledge of weapons effects and the response of protective structures to nuclear and conventional munitions; (4) and providing technology for decreasing an enemy's ability to acquire targets, thus increasing the survivability of fixed installations supporting combat operations.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	8226	7479	8918	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	8266	8410	9402	Continuing	Not Applicable

The decrease of \$40 thousand in FY 1982 results from reprogramming to a higher priority program. The decrease of \$931 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act. The decrease of \$484 thousand in FY 1984 is a result of reprogramming to higher priority programs and new thrusts and revision of the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #62719A

Title: **Mobility and Weapons Effects Technology**

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Program Element #61102A (Defense Research Sciences), Project #AT22 (Research in Soil and Rock Mechanics), and Program Element #63734A (Combat Engineering Systems), Project #DT08 (Military Construction and Field Engineering). Formal coordination of related mission-oriented research by the Navy, Air Force, Defense Nuclear Agency, Department of the Interior, Department of Transportation, Department of Energy, and the US Army Materiel Development and Readiness Command is conducted through annual technical reviews, the Joint Services Civil Engineering Research and Development Coordinating Group, and joint interagency activities. Informal coordination is conducted through frequent individual contacts. Coordination precludes duplication of effort.

F. (U) WORK PERFORMED BY: Approximately 80 percent of the work is performed in-house. The US Army Engineer Waterways Experiment Station, Vicksburg, MS, serves as the managing laboratory and is the primary performing activity. A portion of the work in the weapons effects area is performed by the US Army Construction Engineering Research Laboratory, Champaign, IL. Contractors are selected in accordance with Defense Acquisition Regulation procedures.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AT40 — Mobility and Weapons Effects Technology: This Project is the Army's primary technology base research program in military engineering that supports the combat engineer on the battlefield. The basic objective of the project is to develop techniques and criteria for improving Army mobility, countermobility, survivability, weapons effects, and construction capabilities on the battlefield. FY 1982 accomplishments included development of a model for predicting penetration of projectiles into boulder screens to protect buried structures, damage predictions for the Warsaw Pact petroleum distribution system, microprocessor-based procedures for tactical streamflow forecasting, and guidance for compaction of dry soils and identification of construction materials indigenous to the Middle East. Major milestones for FY 1983 are to develop a method for predicting vulnerability of industrial buildings to tactical nuclear weapons, complete designs for protective revetments for artillery emplacements, develop guidelines for location of underground water and harvesting of water to support military operations in desert regions, and to complete an improved methodology for design and construction of pilings in swelling soils. FY 1984 milestones include development of techniques for rapidly emplacing atomic demolition munitions in areas where prechambers do not exist, models for predicting obstacle barrier/counterbarrier effectiveness in combat operations and vehicle movement along roads and trails, terrain background signature data bases for Europe and Southwest Asia for use in evaluating mine detection systems, and methods for rapid rehabilitation of war-damaged port facilities.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #82720A

Title: Environmental Quality Technology

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	7129	8683	8363	8722	Continuing	Not Applicable
D048	Environmental Quality Research and Development	2139	2516	2534	2763	Continuing	Not Applicable
A835	Military Medical Environmental Quality	3152	3743	3379	3434	Continuing	Not Applicable
A896	Environmental Quality of Military Facilities	1838	2424	2450	2525	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Environmental quality regulations require the Army to minimize the impact of its operations on the environment. This program element provides the technology base to support the Army's effective compliance with local, state, and Federal regulations. The program element establishes environmental effects data on Army-unique materials to provide criteria for design and development of monitoring systems and pollution abatement technology. New methods for disposal, treatment, and reuse of pollutants generated by Army facilities and activities, and development of data bases and models for effective management and control of pollution abatement operations are also investigated under the program element.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	7129	8683	8363	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	7483	8706	9527	Continuing	Not Applicable

In FY 1982, a reduction of \$354,000 resulted from reprogramming to higher priority Army programs. In FY 1983, a decrease of \$23,000 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. In FY 1984, a decrease of \$1,164,000 resulted from reprogramming of funds to higher priority Army programs.

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Program Element: #62720A

Title: Environmental Quality Technology

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Project #AH68 (Processes in Pollution Abatement Technology) and #BS04 (Identification and Health Effects of Military Pollutants) in Program Element #61102A (Defense Research Sciences) comprise the basic research portion of the Army Environmental Quality Technology Base Program. Project #AH68 is concerned with gaining an understanding of the fundamental chemical/physical processes that occur during treatment/disposal of munitions waste; Project #BS04 is concerned with investigating the feasibility of developing less costly and time-consuming methods for conducting toxicology studies. Other related program elements include #62704A (Military Environment Criteria Development), which provides support to the Army Installation Restoration Program and #62777A (Systems Health Hazard Prevention Technology), Project #A878 (Health Hazards of Military Materiel). Project #A878 addresses the occupational health research program of The Surgeon General. Program Element #62720 provides technology transfer to the pollution abatement activities being accomplished in the Military Construction, Army (MCA) and the Operations and Maintenance, Army (O&MA) appropriations. There is no unnecessary duplication of effort within the Army or the Department of Defense. Unnecessary duplication is avoided through annual budget/apportionment reviews and periodic Topical Reviews on program areas of tri-Service interest. Semiannual meetings of the Joint Services Civil Engineering Research & Development Coordination Group (JSCERDCG) enable coordination of technical programs among the Services. Service coordination is further enhanced through the DOD Area Coordination Paper Nr. 42 on Environmental Quality Research and Development. Inter-Service coordination occurs routinely at the technical level on joint programs and technical efforts of mutual interest. Other Federal agencies pursue environmental quality research programs related to their roles in the Federal Government. Coordination is undertaken with appropriate agencies to avoid duplication. In May 1981, a Memorandum of Understanding between the Department of the Army and the US Environmental Protection Agency formalized coordination and cooperation on research activities.

F. (U) WORK PERFORMED BY: Approximately 40% of the research effort is performed in-house by the US Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD; US Army Armament Research and Development Command, Dover, NJ; Natick Research and Development Laboratories, Natick, MA; Mobility Equipment Research and Development Command, Fort Belvoir, VA; Test and Evaluation Command, Dugway Proving Ground, UT; Medical Bioengineering Research and Development Laboratory, Fort Detrick, Frederick, MD; the Construction Engineering Research Laboratory, Champaign, IL; the Waterways Experiment Station, Vicksburg, MS, and the Cold Regions Research and Engineering Laboratory, Hanover, NH. Major Contractors include: Hercules Inc, Radford, VA; ITT Research Institute, Chicago, IL; SRI International, Menlo Park, CA; Mason and Hanger, Middletown, IA; Thiokol Inc, Shreveport, LA; other contractors include: University of Illinois, Champaign, IL; EGG&G Biomix, Wareham, MA; JRB Associates, McLean, VA; and A. D. Little, Inc, Cambridge, MA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

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Program Element: #62720A

Title: Environmental Quality Technology

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

1. (U) **D048 — Environmental Quality Research and Development:** This project is aimed at providing cost effective technology in support of the Army's need to achieve compliance with pollution abatement and environmental enhancement requirements for its industrial plants. The technical thrust areas of the project are reduction, control, and treatment of wastes from the production of munitions for all Services; the recovery of useful resources from the demilitarization of a growing stockpile of obsolete, conventional munitions; the development of automated monitors to detect specific pollutants and assure compliance with effluent discharge permits; and development of pollution abatement techniques required for new and existing Army materiel throughout its life cycle including disposal. FY 1982 accomplishments include: Completion of studies to define technology for treatment of "pink water" from munitions plants; studies to define treatment technologies for electroplating waste and paint sludges; research for reformulation of paints to reduce volatile organic emissions and completion of biological treatment studies for disposal of explosive and propellant manufacturing wastes. FY 1983 goals or milestones include initiating studies to develop treatment methods for production waste from manufacture of ballpowder, nitroguanidine, and nitramine and completion of development of selected technologies for treatment of munition plant wastewaters; demonstration of a new sulfide precipitation system for treating electroplating wastewater; new treatment technology development for paint and degreaser sludge; additional formulations for military paints and coatings with reduced air emissions; explosive recovery and reuse techniques; and standardized analytical methods for analysis of explosives in waste streams. FY 1984 plans include initiation of investigations into application of supercritical fluid reaction technology to treatment of hazardous wastes and completion of investigations in solid waste recovery and reuse techniques for conventional explosives and propellants in the DOD obsolete ordnance inventory; development of instrumental monitors for hazardous materials in munition plant effluents; and treatment systems for wastes from military depot operations.

2. (U) **A835 — Military Medical Environmental Quality:** This project has as its purpose the development of a scientific data base covering the health and environmental effects of Army relevant chemicals. The data generated by this research are used to provide criteria for development of new or confirmation of the adequacy of existing pollution abatement technologies. The data base is also used to lessen the impact of training activities by identifying the environmental effects of the use of smokes and obscurants. This information will allow more rational use of training areas and assist in increasing the readiness of the Army. In FY 1982, interim milestones toward completion of toxicological studies on the explosives TNT, RDX, and HMX studies were completed, and studies of the environmental effects of smokes and obscurants and military hazardous materials were initiated. In FY 1983, environmental effects criteria levels for protection of human health and the environment are being completed for RDX and HMX explosive compounds; studies on nitroguanidine and diethylene dinitrate propellants have been initiated; the environmental effects of military hazardous materials, toxicological studies on TNT, and the fate and transport of smokes and obscurants are being continued. In FY 1984, environmental criteria levels for TNT will be completed; toxicological studies will be initiated on propellants and smokes and obscurants; and chemical characterization studies of Army munition plant air discharges will be initiated.

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Program Element: #62720A

Title: Environmental Quality Technology

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

3. (U) A896 — Environmental Quality of Military Facilities: This project is aimed at solving problems in preserving and protecting the natural environment at Army installations without jeopardizing the Army training and readiness mission. Research is needed to provide the technology to: (1) maintain and enhance realistic training environments which are compatible with multiple use objectives and (2) minimize the cost to the Army for management, control, disposal, or reuse of pollutants generated by Army operations and facilities. Accomplishments in FY 1982 included: completion of investigation of foam reduction of noise during training; completion of guidelines for multiple use of water at fixed Army installations; and identification of treatment of landfill leachate by discharge to lagoons as a cost effective method. FY 1983 activities include: development of range utilization procedures as a component of a training area environmental impact prediction capability; study of guidelines for upgrading sewage treatment plant trickling filters using plastic media; and field testing of the Environmental Early Warning System for predicting environmental problems associated with changes in mission, troop strength, resource management, or land use. Plans for FY 1984 include: investigation of materials to attenuate blast noise; study of technology for cleanup of hazardous waste spills; and investigation of methods to dispose of hazardous residues from pollution control equipment.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62722A

Title: Manpower, Personnel and Training

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	6481	6048	7923	8008	Continuing	Not Applicable
A791	Manpower Personnel and Training	6481	6048	7923	8008	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The volunteer Army today is faced with a dual manning problem: a reduced supply of recruits and increasing demands for high-technology skills for weapon system operation and maintenance. This program element supports the major Army technology thrust in Soldier-Machine Interface. The research is required to produce more effective methods of recruiting, selecting, and assigning personnel. Improved methods of personnel system management are required, especially for use in units. Also, methods are required for integrating the mental and physical capabilities of personnel into the design of new weapons and materiel systems. Research is required to identify and develop a basic knowledge of the parameters to be used in the development of a Life Cycle Personnel Management System. Technology base research is also required to provide an empirical basis for the design and development of appropriate instructional technology and new training programs for individual soldier skill development. Methods to promote soldier commitment to the Army and to enhance unit cohesion while sustaining high performance are also needed.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	6481	6048	7923	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5872	7370	8510	Continuing	Not Applicable

The increase of \$609 thousand in the FY 1982 funding level is a result of reprogramming from lower priority Army requirements. The funding decrease of \$1322 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act and \$5 thousand reprogramming of funds for the High Technology Light Division. The decrease of \$587 thousand in FY 1984 is a result of reprogramming \$363 thousand to Program Element #63731A.

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Program Element: **#62722A**

Title: **Manpower, Personnel and Training**

DOD Mission Area: **#522 — Environmental and Life Sciences (ED)**

Budget Activity: **#1 — Technology Base**

Manpower and Personnel, due to realignment of program objectives. The remaining FY 1984 reduction of \$224 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Products developed within this program that require further research effort move to advanced development in Program #63731A (Manpower and Personnel) and #63743A (Education and Training). This effort is coordinated with Air Force Personnel Utilization Technology, PE #62603F; Navy Personnel Support Technology, PE #62763N; Education and Training, PE #63743A; Training and Simulation Technology, PE #62205F. Inter-Service coordination to prevent unnecessary duplication and to maximize benefits is assured through Department of Defense-sponsored topical reviews, annual budget and apportionment reviews, tri-Service participation in preparation of Technology Coordinating Papers and Technical Advisory Groups in such areas as selection and assignment techniques, leadership development, and technical training. Coordinated research programs are conducted with the Air Force, Navy, and Department of Labor.

F. (U) WORK PERFORMED BY: (Primary Contractors) McFann, Gray & Associates, Inc., Monterey, CA; Human Resources Research Organization, Alexandria, VA; Anacapa Sciences, Inc., Santa Barbara, CA; General Research Corp., McLean, VA; Dynamics Research Corp., Wilmington, MA. The total value of the twenty-two additional contracts is \$2,915,344. The Army developing organization responsible for this program is the US Army Research Institute (ARI) and its field activities which are collocated at Army operational commands.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: A791 — Manpower Personnel and Training: This project is a continuing exploratory development effort to provide the most effective human technology data for developing principles to improve the utilization of the Army's personnel resources. New advances in understanding human performance are combined with technological advances, such as micro-electronics, to improve the Army's ability to train and utilize soldiers. Progress in the measurement of human performance capabilities and job requirements, combined with development of sophisticated allocation models, provides the basis for significant improvement in performance Army-wide. In FY 1982, major portions of a Longitudinal Data Base were developed to forecast manpower resources/requirements for planning and further research purposes. Data collection and analysis of enlisted attrition were completed. The relationship of unit and commander characteristics to unit personnel management was determined. Instructional material for the application of Life Cycle Cost Analysis technology to human factors, manpower, personnel, and training issues in military systems development was prepared, and algorithms for converting system behavioral requirements to Military Occupational Specialty (MOS) requirements were completed. Experimental learning materials for spatial orientation and navigation skills were completed; developmental work on the Army Education Instructor System was completed; and the prototype for a hand-held device to teach job-related vocabulary was produced. A Maintenance Performance System for providing management information to improve training was implemented. Development of interactive videodisc procedures for Instructional Systems Development was completed. Requirements for a long-range effort to validate the Armed Services Vocational

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Program Element: #62722A

Title: Manpower, Personnel and Training

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

Aptitude Battery (ASVAB) were identified and contracts awarded. In FY 1983, soldier-accessioning variables will be developed into a matrix including demographics, geographic, socioeconomic, gender motivational and organizational factors, for use in developing techniques to improve soldier-to-job matching. The methodology for determining job similarity for a selected set of MOS will be developed to aid in clustering of MOS for selection and classification purposes. A quantitative model for reenlistment decisionmaking will be developed to contribute to the development of methods to increase reenlistment rates of highly qualified personnel. Measures of unit efficiency will be developed for field testing. User evaluations of methods for integrating human performance considerations in weapon systems design will be documented. Training aids will be developed for users of the Early Training Estimation System which identifies training requirements early in weapon systems development. Final specifications for the Army Education Instruction System will be completed. The FY 1984 program includes the following: New prediction instruments to improve Army selection and classification will be provided. Counterattrition programs will be validated. Decisionmaking models and techniques for increasing unit integrity will be field-tested. Management information system requirements for the manpower and personnel planning process will be established. The Spatial Data Management System for Basic Skills and the Functional Vocabulary Tutor for language training will be transferred to the field. A second-generation Army cognitive learning strategies curriculum will be developed. A system for management assessment and training will be expanded to an organizational testbed prototype.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #82723A

Title: Clothing, Equipment, and Shelter Technology

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	4827	8000	6468	6977	Continuing	Not Applicable
AH98	Clothing and Equipment Technology	4283	7598	5912	6376	Continuing	Not Applicable
A427	Tactical Rigid-Wall Shelters	544	402	556	601	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A requirement exists to improve combat clothing, individual equipment, field service support equipment, and shelters in order to significantly increase the soldier's effectiveness in combat and survivability on the modern-day battlefield. Improved combat clothing will increase the soldier's combat effectiveness in all environments, minimize physiological stress, and provide an increase in camouflage, ballistic, chemical, flame, auditory, sound overpressure, and thermal protection. Exploratory development of tactical rigid-wall shelters will improve the capability of the shelters to resist the threats of nuclear, chemical, biological, and conventional warfare. This element is part of a Department of Defense (DOD) effort to meet the International Organization for Standardization (ISO) specifications for movement of shelters by container ships and simultaneously to reduce the proliferation of various sizes and types of tactical shelters and special-purpose vans currently in the inventory, to provide improved performance, and to reduce maintenance time and costs. Exploratory development effort in tentage is required to attain the capability to design air and frame supported tentage which meets new operational/mobility requirements under worldwide climatic extremes, uses new materials and design concepts to provide protection under chemical warfare conditions, and reduces the logistical support and financial investment required for current field shelters. Exploratory Development effort in field service support equipment is required to provide field equipment with significantly greater mobility and improved efficiency by using less fuel and power, by reducing or eliminating water consumption and waste products, and by reducing visual and thermal signature and noise levels. This effort currently addresses field sanitation/personal hygiene systems essential to the health and welfare of the combat soldier and which must be compatible with chemical warfare operation.

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Program Element: #62723A

Title: Clothing, Equipment, and Shelter Technology

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	4827	8000	6468	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5574	6970	7251	Continuing	Not Applicable

The funding decrease of \$747 thousand in FY 1982 is a result of reprogramming to higher priority Army requirements. The funding increase of \$1030 thousand in FY 1983 is the net effect of reprogramming of funds for Compartmented Programs and Congressional direction in the FY 1983 Appropriations Act. The funding decrease of \$672 thousand in FY 1984 is the net effect of a reduction in the scope of effort to fund higher priority Army technology base programs and an increase of funds for a Compartmented Program. The remaining FY 1984 reduction of \$111 thousand resulted from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: In order to preclude a duplication of effort, related research is coordinated with each of the other military services who develop their own service-related clothing and individual equipment items. Coordination and liaison with industry is accomplished by the US Army Natick Research and Development Laboratories. The Exploratory Development efforts in clothing and equipment move to Advanced Development under Program Element #63747A (Soldier Support/Survivability), Project D689 (Clothing and Equipment), and to Engineering Development under Program Element #64713A (Combat Feeding, Clothing, and Equipment), Project DL40 (Clothing and Equipment). Advanced Development in tactical rigid-wall shelters is performed in Program Element #63726A (Combat Support Equipment), Project D428 (Tactical Rigid-Wall Shelters). Engineering Development is conducted in Program Element #64717A, (General Combat Support), Project #D429 (Tactical Rigid-Wall Shelters). Basic research is conducted in Program Element #61102A (Defense Research Sciences), Project AH52 (Support of Equipment for the Individual Soldier).

F. (U) WORK PERFORMED BY: The major in-house effort is performed by the US Army Natick Research and Development Laboratories, Natick, MA. Other Government activities involved are the US Army Institute of Environmental Medicine, Natick, MA; US Army Materials and Mechanics Research Laboratory, Watertown, MA; US Army Human Engineering Laboratory, Aberdeen Proving Ground, MD; Dugway Proving Ground, UT; and US Army Armaments Command, Dover, NJ. Current contractors are Kaman Avidyne, Burlington, MA; Albany International, Dedham, MA; Fram Corp, East Providence, RI; Fiber Materials, Biddeford, ME; Declog Inc., Melville, NY; and Bolt, Beranek and Newman, Cambridge, MA.

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Program Element: #62723A

Title: Clothing, Equipment, and Shelter Technology

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) **AH98 — Clothing and Equipment Technology:** This program is designed to improve human performance and soldier survivability on the modern-day battlefield through significantly improved fibers, fabrics, materials, and new design applications for combat clothing, personal equipment, and field service support equipment and tentage. During FY 1982, fabrics having combined protection against chemical agents and flame were developed and used for the protection of aircrewmembers and combat vehicle crewmembers. Developed new concepts and structures providing chemical protection. Evaluated a new, experimental fiber for ballistic resistance properties. Completed initial evaluation of flexible materials for protection from sound blast-wave overpressure. A system analysis was initiated to develop concepts for a new generation of general-purpose tentage which can effectively meet the chemical warfare threat. Contract work was initiated to devise a technique to harden the tent, extendable, modular, personnel (TEMPER) against chemical agents as an interim solution to the CW threat. Work was initiated specifically directed toward defining lightweight fabric laminate systems for use in a chemical warfare environment. An assessment of low-cost air beam fabrication techniques was completed. Design, fabrication, and testing of diesel-fueled, nonpowered field heater prototype was completed. A system analysis on new concepts for a future field bath/laundry/decontamination system was completed. The FY 1983 program includes effort to provide the soldier with maximum ballistic protection in light of the novel threats faced; continue work on new concepts to incorporate chemical, biological, ballistic, camouflage, and flame protection into one combat uniform; initiate in-house and contract efforts on new laundry alternatives for the field which can markedly reduce water and power requirements while also providing the capability to decontaminate clothing containing chemical agents; initiated development of clothing and equipment for the special operation forces for use in various climatic environments; complete fabrication of a lightweight prototype tent, extendable, modular, personnel (TEMPER), hardened against chemical warfare threat, and test with live agents. In FY 1984, evaluate the development of fibers and fabrics for chemical and biological protective clothing and select candidates for development of prototype items. Incorporate chemical, biological, ballistic, camouflage, and flame protection into one combat uniform using the most promising concepts developed in prior years; determine optimum fabric/fiber forms or combinations of material for use in body armor to provide the soldier ballistic protection; define the level of weight reduction of combat clothing that will still maintain protective qualities; continue development of clothing and equipment for the special operation forces for use in various climatic environments; develop improved auditory protective systems; produce prototype camouflage clothing to determine its ability to counter current detection devices; finalize work on fabric systems that increase the protection level against directed energy sources such as lasers; apply designed eye protection technology into prototypes that protect against high energy flame, nuclear, and directed energy sources; explore methods for protecting Army materiel and systems from microbiological deterioration. In addition, complete contract effort on an integrated bath/laundry/decontamination system; conduct live agent testing of hardened tent (TEMPER); procure a quantity of selected concept laminated material for tentage for chemical warfare agent protection evaluation; and complete analysis and design of potential barrier systems for aircraft maintenance shelters.

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Program Element: #62723A

Title: Clothing, Equipment, and Shelter Technology

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

2. (U) **A427 — Tactical Rigid-Wall Shelters:** This program is designed to develop tactical shelters which not only protect against worldwide environmental extremes, but also protect against nuclear, chemical, ballistic, and electromagnetic threats. Weight and cost parameters must be kept in control so that completed systems can be fielded on an accelerated basis. Technology derived from this program will result in standard multipurpose, NBC-hardened shelters for all of the Department of Defense. FY 1982 and prior accomplishments include the completion of an analysis to determine the need for welded joints in tactical shelter panels. Structural models were then developed to evaluate design changes in shelters subjected to both static and dynamic loading. Work was conducted on the investigation of the effect of thermal stresses on the integrity of the bonding in sandwich panels for tactical shelters. Effort on the optimization of frame and panel structures for weight reduction was initiated. A preliminary analysis was conducted to determine the dynamic loading of tactical shelters from nuclear blast effects. From this analysis, a prototype unit was designed and built and successfully tested during a field nuclear blast simulation. The shelter withstood the blast without any physical damage. Shelter response data from this blast test is being used to validate the design analysis computer codes. Alternative lightweight panel designs were developed for evaluation in the shock tube based on the results of nuclear blast simulation analysis. Prototype electromagnetic interference/radio frequency interference shielding to a level of 60dB for the nonexpandable shelter was completed, and hardening of tactical shelters against electromagnetic pulse threat was initiated. Initiated analysis of thermal protection concepts for panels and on alternative framing options to reduce weight of nuclear-hardened shelters. Developed computer models to analyze stress distributions and load paths under static and dynamic loading environments and applied to design problems arising during engineering development of nonhardened structures. The program for FY 1983 will complete the evaluation in the Ballistic Research Laboratory shock tube of alternative lightweight panel design concepts for nuclear overpressure applications. Complete the development of techniques to meet the thermal threat and the electromagnetic pulse from nuclear weapons. Fabricate panels to meet the total nuclear threat and test these panels in the FY 1985 blast test. Develop means to meet the ballistic threat which can be integrated into panel constructions capable of meeting both the nuclear and ballistic threats; initiate feasibility demonstration of these constructions. Initiate the analysis and prototype design of tactical shelters which can meet all structural and threat requirements while minimizing weight and cost. In FY 1984, using results from the shock tube testing, select optimum panel material and design for overpressure protection. Initiate selection of thermal bumper. Analyze data from nuclear blast simulation testing. Continue to investigate means to harden tactical shelters against the integrated battlefield threat. Continue optimum design effort including the use of composite materials for frame members as well as various frame and panel concepts.

H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:** Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62724A

Title: Joint Service Food System Technology

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	5556	5580	6106	6583	Continuing	Not Applicable
AH99	Joint Services Food/Nutrition Technology	5556	5580	6106	6583	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: As Executive Agent, the Army conducts the DOD Food Research, Development, Test and Engineering Program in support of all military services as well as the Defense Logistics Agency. Military food service operations are conducted under highly unique conditions and are subject to exceptionally stringent constraints such that specialized foods, packaging, and equipment are required. This program is responsive to these needs and includes the support for ground combat, air and shipboard operations, and garrison-specialized situations. Examples of these unique military needs include extending the stability and safety of special combat rations designated for prepositioned war reserves; reducing weight and volume of rations to minimize the logistical burden to accommodate extreme space limitations associated with military weapon systems such as nuclear submarines and ground armored vehicles; packaging to survive extreme mechanical environmental stresses through long supply routes to remote locations and airdrop delivery systems; insuring essential nutrition under extreme climatic conditions, and possible chemical, biological and/or nuclear contamination to military forces worldwide.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	5556	5580	6106	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5556	5595	7012	Continuing	Not Applicable

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Program Element: #62724A

Title: Joint Service Food System Technology

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

The funding decrease of \$15 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTEA appropriation. The funding decrease of \$892 thousand in FY 1984 is a result of the reduction in scope of program to fund higher priority Army technology base programs. The remaining FY 1984 reduction of \$14 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program is jointly developed by all military services via the Joint Formulation Board and, as such, eliminates any duplication of effort. Follow-on DOD Food Research, Development, Test and Engineering Programs include program element 63747A, Soldier Support/Survivability, project D610, Food Advanced Development, and 64713A, Combat Feeding, Clothing and Equipment, project D548, Military Subsistence Systems. Basic research is conducted in program element 61102A, Defense Research Sciences, project AH52, Support of Equipment for the Individual Soldier.

F. (U) WORK PERFORMED BY: In house effort is accomplished by the US Army Natick Research and Development Laboratories, Natick, MA. Other Government activities providing support include the Construction Engineering Research Laboratory, Champaign-Urbana, IL; the regional laboratories of the Department of Agriculture; and the US Army Missile Command, Redstone Arsenal, AL. Academic institutions performing work in this program include Rensselaer Polytechnic Institute, Troy, NY and Stanford University, Stanford, CA. Current contractors are Dynamic Sciences, Phoenix, AZ; Mine Safety Appl. Co, Murraysville, PA; Computer Engineering Associates, Avon, MA; and the National Academy of Sciences, Washington, DC.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AH99 — Joint Services Food/Nutrition Technology: The US commercial food industry is based on a sophisticated, labor-intensive, high-energy system of distribution of mostly refrigerated and frozen food products, or shelf-stable products with short shelf lives. The food industry is oriented towards transfer of food from the farm to the local supermarket. Military food service, on the other hand, is generally provided within the context of extremely unstable, often violent, and potentially contaminated surroundings with little time or labor available for careful preparation, located anywhere in the world, transported by any available means, and often drawn from prepositioned stocks stored under potentially adverse conditions for long periods of time. An organized systematic approach is used to assess the capabilities and deficiencies of existing military food service systems and to identify available technology and projected advancements in food, equipment, packaging and related fields which can be applied to the services' feeding problems. The objective is to upgrade the responsiveness of the military food service system to existing and projected operational requirements. New concepts developed under this program utilize the most cost effective solutions with the shortest feasible development cycle. During FY 1982 and prior, prototypes of the new Mobile Food Service Unit, a major component of the new Army Combat Field Feeding System, were successfully tested during three field exercises verifying that the concept provides highly mobile units requiring minimal setup time and manpower, with heat on the move capability for distributing highly acceptable hot meals. A prototype of a new

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Program Element: #62724A

Title: Joint Service Food System Technology

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

consolidated field feeding unit capable of feeding 1100 troops was successfully tested, and as a result the Air Force plans to retrofit all its war reserve field support systems as well as to outfit its Rapid Deployment Force with this new Harvest Eagle Food Service System. New ration dense foods were tested on Navy submarines with results indicating that both submarines and surface ships will significantly increase voyage endurance. A new hospital food service system was designed and tested with high patient acceptance and significant food service labor savings. An initial prototype liquid food supplement packaged in a flexible, protective mask-compatible pouch for use by encapsulated military personnel in a toxic environment has been developed. The liability to toxic agent penetration of a number of subsistence packaging materials has been evaluated. In FY 1983, it is planned to continue effort on the Combat Field Feeding System, including tray pack menu items; analysis and design of Navy Food Service Systems Afloat, Air Force Field Feeding System for Ground Launched Cruise Missile System, Field Feeding in an NBC Environment, Development and Evaluation of Improved Food Service Management System, development of a substitute compound for field sanitization, systems analysis of Navy Automation of Food Service Records, development of new compounds for water purification, determination of effects of prolonged use of combat rations on troop effectiveness, systems analysis to define required types of rations to support amphibious operations, development of packaged bread for field feeding, defining thermal detectability of field feeding systems; complete the Marine Corps Combat Food Service Concept for the 1990s, analysis of food systems at collocated bases; and initiate systems analysis of Food Service Systems Shipboard, development of canteen element for water consumption in an NBC environment, design of Air Force in-flight feeding system, development of hospital rations, systems analysis of ADP support for food service, systems analysis of combat food service in the year 2000 and beyond, development of rations compatible with in-vehicle food service equipment, systems analysis of cold weather arctic field feeding, and concept evaluation in support of the High Technology Test Bed. In FY 1984, complete the Navy Food Service Systems Afloat analysis, the Air Force Food Service System for the Ground-Launched Cruise Missile system, systems analysis of Navy Automated Food Service Records, systems analysis to define required types of rations to support amphibious operations, effort to develop packaged bread for field feeding, and concept evaluation in support of the High Technology Test Bed. Continue all other effort ongoing in FY 1983 and initiate effort to develop advanced technology for high-density foods and determine nutritional adequacy and stability of new and improved combat ration technology and feasibility of nutrient sustenance module.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62725A

Title: Computer and Information Sciences

DOD Mission Area: #521 — Electronic and Physical Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1884	1961	1978	2239	Continuing	Not Applicable
DY10	R&D in Multicommand Data Systems	1884	1961	1978	2239	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program's major thrust is to develop and use advances in computer software technology for near-term cost and quality improvements for multicommand nontactical automatic data processing (ADP) systems. Included are research and exploratory development efforts to: (1) Assist DOD/DA program managers in the planning and control of software development; (2) increase the reliability, usability, adaptability, and cost-effectiveness of multicommand ADP systems and defense computer applications; (3) reduce the time and costs attributed to software development and maintenance; (4) focus on the support of current standard programming languages, including the development of programming and management tools for the effective implementation of a new standard high-order language; (5) work on advanced hardware peripherals and computer technology included in support of the Standard Army Multicommand Management Information Systems (STAM-MIS), combat service support systems, and the acquisition of the Vertical Installation Automation Base Line (VIALB); and (6) solve technical software issues for instituting a distributed combat service support control system.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	1884	1961	1978	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	1794	1966	2181	Continuing	Not Applicable

Funding in FY 1982 was increased to take advantage of research accomplishments in automating the requirement. The funding decrease of \$5 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE,A appropriation. The \$203 thousand reduction in FY 1984 is attributable to minor reduction in program tasks and a change in the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #62725A

Title: Computer and Information Sciences

DOD Mission Area: #521 — Electronic and Physical Sciences (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Related activities are: (1) The Army's Program Element #63723 (Command and Control), Project D101 (Tactical Automation), Project D185 (Military Software Standard), and Project D186 (Military Computer Family AD); (2) Program Element #62746 (Tactical ADP Technology); and (3) Program Element #63756A (Advanced Software Technology). Research projects supported by this program element are coordinated by the DOD Management Steering Committee for Embedded Computer Resources and other DOD panels/committees. Continued liaison at the laboratory and action officer level with Navy and Air Force counterparts minimizes duplication of work.

F. (U) WORK PERFORMED BY: Major contractors are Georgia Institute of Technology, Atlanta, GA; Raven Systems and Research, Inc., Washington, DC; Purdue University, Lafayette, IN; International Software Systems; McCabe and Associates, Columbia, MD; with remaining contracts amounting to \$217 thousand. In-house developing agencies include: the US Army Institute for Research in Management Information and Computer Sciences (AIRMICS), Atlanta, GA; Office of the Chief of Engineers, the Military Personnel Center, the Soldiers Center, the US Army Training and Doctrine Command, and the US Army Computer Systems Command.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: DY10 — R&D in Multicommand Data Systems: The purpose of this project is to provide the resources for planning, initiating, and directing exploratory research in support of the Army's Large, standard multicommand management information systems, their related software, hardware, methodologies, and practices. This is strongly needed to exploit and accelerate application of information technology to Army business practices entailing the functional areas of personnel, finance, logistics, and health services. During FY 1982 an experimental version of the Automated Requirements System was demonstrated and is currently undergoing test and evaluation. A microprocessor-based Local Computer Network Testbed was completed along with a traffic generator and network monitor to assess traffic loads under alternative network architectures. Assessment of ADA versus COBOL environments was completed and briefed to command representatives. An automated resource-estimating tool was completed and presented to the user community. Detailed plans for distributed processing research in support of the combat service support (CSS) function were developed and coordinated with respective Army agencies. During FY 1983 test and evaluation of the experimental automated requirements system will be completed along with specification of Decision Support System design and development methodologies for the combat service support function. An automated measurement tool and software project management system will be transferred to user activities. In FY 1983, research will begin in distributed software engineering and application of advanced technology to command and control problems in the Combat Service Support area. Research will include aspects of data management, the generation of decision support systems, and development of "rapid prototype" systems for interfacing with the automated requirements system. Advanced research will be supported by installation of a VAX 11/780 computer. In FY 1984, user documentation for the decision support system aids developed during FY 1983 will be completed as well as a software programming effort forecaster based on research successes in software complexity and quality measures. Research into ADA operating system requirements for selected target machines and the integration of ADA with related programming support environments will be started during FY

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Program Element: #62725A

Title: Computer and Information Sciences

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

1984. During this timeframe, an automated requirements system for use with ADA in the Army's Vertical Installation Automation Base (VIALE) system will be started in parallel with implementation of a combat service support testbed for evaluating aspects of distributed battlefield automated systems.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62727A

Title: Non-System Training Devices (NSTD) Technology

DOD Mission Area: #622 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2457	2892	4625	4990	Continuing	Not Applicable
A230	NSTD Technology	2457	2892	4625	4990	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Exploratory Development program contributes directly to the major Army technology thrust in Soldier-Machine Interface and provides the technology base to support future Non-System Training Device developments. Non-System Training Devices are developed to provide general military training and training on more than one item/system. Modern weapons systems are being integrated into the force at unprecedented rates. Arrival of this sophisticated, high-technology equipment will coincide with increased constraints on people, dollars, and time in a training environment where the cost of ammunition and equipment operation continues to rise. Training devices and training simulation provide force multipliers that improve combat effectiveness. The combat effectiveness of Army personnel is key to both compensating for the numerical superiority of opposing forces and for maintaining a ready force. This combat effectiveness can best be achieved by innovative, efficient, and results-oriented training. The major thrust in the development of new training devices is to develop equipment that allows a high transfer of knowledge and experience from the training situation to a combat situation. The Army has a continuing need to expand the technology base for training devices and simulation to support the development of training environments and training systems that provide the training required to win in any conflict.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2457	2892	4625	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	2857	2900	4709	Continuing	Not Applicable

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Program Element: #62727A

Title: Non-System Training Devices (NSTD) Technology

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

Reduction of \$200 thousand in FY 1982 is a result of reprogramming of funds to higher priority Army requirements. The funding decrease of \$8 thousand in FY 1983 is a result of pro rata application of Congressional reductions to the RDTEA appropriation. The FY 1984 reduction of \$84 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: To avoid duplication of effort, close coordination is maintained with other Services through Training and Personnel Technology Conferences, Topical Reviews, Joint Service Technical Coordinating Group—Simulators and Training Devices, Department of Defense Simulator Technical Advisory Group, worldwide staffing of training device requirements, and the collocation of the Office of the Army Project Manager for Training Devices (PM TRADE) and the Naval Training Equipment Center (NTEC). The technology/devices developed within this program normally progress to Non-System Training Devices (NSTD) Development (PE #63738A) and/or NSTD Engineering (PE #64715A).

F. (U) WORK PERFORMED BY: In-house development is performed by the Project Manager for Training Devices, Orlando, FL; Naval Training Equipment Center, Orlando, FL; United States Army Armament Command, Dover, NJ; and Letterman Army Institute of Research, Presidio of San Francisco, CA. Prime contractors include Grumman Aircraft, Long Island, NY; Seville Inc., Pensacola, FL; Sanders Associates, Nashua, NH; and Burtech, Tulsa, OK.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: A230 — Non-System Training Devices Technology: This continuing program provides for the Exploratory Development of training devices that are developed to support general military training and training on more than one item/system. The effort under this program is directed towards providing a technology base in support of Army training device development. The cost of training with operational equipment, the lack of available training areas, and the need for high levels of proficiency to achieve full combat effectiveness require continuing examination of approaches to simulation and training devices. This program provides the necessary "front-end" analytical effort required to smoothly advance developments into Advanced Development and Engineering Development. The preliminary systems engineering design effort of the Army Maintenance Training and Evaluation Simulation System (AMTESS) concept was concluded with the delivery of breadboard models for test and evaluation by the proponent schools. Training effectiveness analysis of the AMTESS breadboards was initiated in FY 1982. The results of this effort will provide the technical and operational base for more efficient and effective development of Army maintenance training equipment. During FY 1983, TV game technology will be evaluated towards design of compact, portable, interactive small unit and crew gunnery proficiency trainers. The Computer-Generated Imagery (CGI) effort will continue with the development of models that portray visual scenes with enough realism for effective use in visual simulators. Current computer-generated imagery training systems cannot meet target identification requirements at far ranges and are limited because they cannot process enough information to generate high-detail targets or background scenes. The Hybrid Interactive Visual Scenes effort will be directed toward resolving these limitations for selected portions of the viewing field. This cooperative effort with the Naval Training Equipment

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Program Element: #62727A

Title: Non-System Training Devices (NSTD) Technology

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

Center will continue with emphasis on the utilization of novel techniques to provide areas of high detail. During FY 1984, the exploratory efforts on simulation of area weapons effects, which were initiated in FY 1982, will be continued with those technically feasible weapons signature concepts for mine, mortar, nuclear, biological, and chemical (NBC), and cannon artillery systems entering the breadboard fabrication phase. The resulting simulators will be interoperable with the Multiple Integrated Laser Engagement System (MILES). Programs are planned for the development and evaluation of feasible concepts for the simulation of the dirty battlefield effects for use in Engagement Simulation Exercises. The Battlefield Sensor Simulation program will continue with emphasis on developing techniques for portraying the characteristics of such sensors as Forward Looking Infrared (FLIR), Target Acquisition and Designation Sight (TADS), and Pilot Night Vision Sensor (PNVS). This effort will provide the technology base for development of simulators for training surveillance and target acquisition tasks. An effort to portray the thermal images and infrared signature of threat armor weapons will be initiated. Efforts will be initiated to develop an ADP Generic Trainer for training materials common to multiple Programs of Instruction (POI) and to determine cost and technical feasibility of a simulator software test bed and tactical scenario generator. Preliminary engineering designs will be initiated to exploit advances in microprocessor interactive intelligent terminals and computer speech technology in development of a family of low-cost devices for use as tactical Electronic Warfare simulators. Also in FY 1984 a major Army technology base thrust area established in FY 1983 to systematically exploit robotics and artificial intelligence technology will be continued.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62728A

Title: Exploratory Applications of High Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	- 0 -	3861	3888	Continuing	Not Applicable
AH09	Exploratory Applications of High Technology	- 0 -	- 0 -	3861	3888	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Army's light forces urgently require the infusion of high technology to remain competitive with rapidly modernizing potential enemies, while still remaining strategically deployable. Very successful efforts to accomplish this have been underway since 1980 at the 9th Infantry Division High Technology Test Bed (HTTB), Fort Lewis, Washington. To capitalize on these successes and accelerate new efforts, the HTTB is being expanded to become the Army Development and Employment Activity (ADEA). The significance is that the Commander, 9th Infantry Division and ADEA will directly control specified Research, Development, Test, and Evaluation efforts aimed at significantly enhancing the effectiveness of light forces. ADEA will integrate field user, combat developer, and materiel developer efforts to accelerate the recognition, development, and application of new technologies to improve the firepower, mobility, survivability, and strategic deployability of light forces. This program will allow the ADEA commander to influence far term technology applications by supporting laboratory and industrial research, development, and studies, and conducting testbed experimentation with off-the-shelf equipment. It will also give ADEA the capability to take newly emerging technologies in a brassboard state and examine or develop concepts for systems, employment, force structure, and soldier interface. The program will concentrate on technologies which will significantly impact light force capabilities for the 1990s and beyond. This program element contributes directly to the Army's major technology thrusts.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands) Not Applicable. New program start in FY 1984.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program supports the Army's initiative to improve combat readiness and effectiveness by development of high technology for tactical units through user testbed activities. Related technology efforts include: Program Element #63324A (Army Development and Employment Activity (ADEA)), Project #D249 (ADEA Technology Thrust Integration), and Project #D252 (ADEA Concept and Technology Evaluations), and other programs. There is no unnecessary duplication of effort with any Army or DOD programs.

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Program Element: #62728A

Title: **Exploratory Applications of High Technology**

DOD Mission Area: #523 — **Engineering Technology (ED)**

Budget Activity: #1 — **Technology Base**

F. (U) WORK PERFORMED BY: Major Army developing organizations responsible for this program include the Electronics Research and Development Command, Adelphi, MD; the Communications-Electronics Command, Fort Monmouth, NJ; the Missile Command, Huntsville, AL; and the Human Engineering Laboratory, Aberdeen, MD.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AH09 — Exploratory Applications of High Technology (NEW START): This project will expand the scope of the Army Development and Employment Activity (ADEA) to include evaluation of longer range, more broadly applicable technologies which will have clear and significant impact on light force capabilities for the 1990s and beyond. Robotics, fiber optics, and microprocessing techniques are among the technologies that will be investigated in FY 1984 and potentially transitioned to advanced development. Robotics will be evaluated for possible application to remote information collection, route reconnaissance, and countermine capabilities. Fiber optics will be investigated for application to anti-armor weapons, fire control, and communications. Microprocessing techniques will be evaluated for application to command, control, communications, and intelligence.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62730A

Title: Cold Regions Engineering Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	5403	5983	7058	7498	Continuing	Not Applicable
AT42	Design, Construction and Operations Technology for Cold Regions	5403	5983	7058	7498	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objectives of this program are: (1) to insure that Army combat capability continues to improve in winter temperate zones and in extreme cold environments; (2) establish methods for determining the impact of cold regions environmental conditions on the performance of Army materiel and military operations; (3) establish more economical and effective techniques for operating and maintaining cold regions Army facilities; (4) establish design criteria for new materiel and engineering construction to mitigate cold regions environmental effects.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	5403	5983	7058	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5443	6660	6966	Continuing	Not Applicable

The decrease of \$40 thousand in FY 1982 is attributable to the application of Congressionally directed changes. The decrease of \$677 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act. The increase of \$92 thousand in FY 1984 is a result of recalculation of project funding requirements.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

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Program Element: #62730A

Title: Cold Regions Engineering Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

E. (U) RELATED ACTIVITIES: Related to this research are: the Corps of Engineers Civil Works Research and General Investigation programs in Cold Regions Hydrology, Ice Engineering, and Land Treatment; Program Element #61102A (Defense Research Sciences), Project #AT24 (Snow, Ice and Frozen Ground); Program Element #62731A (Military Facilities Engineering Technology), Project #AT41 (Military Facilities Engineering Technology), Project #A896 (Environmental Quality for Military Facilities); and Program Element #62111A (Atmospheric Investigations). There is no duplication of effort within the Army programs; coordination is maintained by means of reports and regular interlaboratory meetings.

F. (U) WORK PERFORMED BY: The US Army Cold Regions Research and Engineering Laboratory, Hanover, NH, is the primary performing activity. Approximately 77% of work is performed in-house. The remaining portions of the work are performed at the US Army Engineer Topographic Laboratories at Fort Belvoir, VA; the US Army Engineer Waterways Experiment Station, Vicksburg, MS; and the US Army Facility Engineer Support Agency, Fort Belvoir, VA. The performing agencies also contract for research support; contractors include the University of Alaska, Fairbanks, AK; Dartmouth College, Hanover, NH; University of Michigan, Ann Arbor, MI; Optimetrics Incorporated, Ann Arbor, MI; Snow-Mech Incorporation, New London, NH; and Sierra Research Incorporated, Sacramento, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AT42 — Design, Construction and Operations Technology for Cold Regions: This research responds to the Army environmental sciences mission assigned to the Corps of Engineers to characterize the environment and assess its impact on Army materiel and operations. In FY 1982, the SNOW-ONE-A winter experiment was conducted in Northern Vermont, 14 major DOD agencies participating. Limited winter battlefield performance data were gathered for Self-Contained Munitions operating in the infrared and millimeter wavelengths. Winter battlefield performance data were collected on artillery-delivered antitank mines, the Soviet RPG-7 antitank weapon, and the Army's float bridge support boat. Snow tires of many types were evaluated for military use, and winter float bridging operations were studied. Ice demolition curves were developed for field use. Facility maintenance and construction engineering accomplishments included techniques for locating buried utilities, criteria for rehabilitation of pavements and other military facilities in cold climates. During FY 1983, the SNOW-ONE-B experiment will provide a preliminary assessment of the effectiveness of manmade obscurants in winter including state-of-the-art infrared and millimeter-wave screeners to include synergistic effects with natural aerosols. Support to facility engineers will produce an Engineer's Guide on the causes and solutions of potholes in pavements including repair methods. During FY 1984, the SNOW-TWO experiment will be conducted in order to determine the combined effects of manmade and natural obscurants on electromagnetic systems performance. Additionally, research will focus on (1) improving tactical bridging capabilities in winter, (2) elimination of ice adhesion on helicopters, and (3) providing more durable and reliable roofs and pavements systems to resist severe winter conditions.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62731A

Title: Military Facilities Engineering Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	3362	4138	4480	4631	Continuing	Not Applicable
AT41	Military Facilities Engineering Technology	3362	4138	4480	4631	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides affordable buildings and facilities and efficient, economical operation and maintenance of installations to support Army training and readiness. The program supports the planning, design, construction, operation, and maintenance of Army facilities worldwide. It provides technology to increase productivity and responsiveness in providing and operating facilities in temperate and tropical climates and to make facilities affordable on a life cycle basis. The program also addresses the development of technology to reduce skill levels and logistics required for construction in theaters of operations.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	3362	4138	4480	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	3397	4250	4422	Continuing	Not Applicable

The reduction of \$35 thousand in the FY 1982 funding level was a result of reprogramming to higher priority Army requirements. The funding decrease of \$112 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation and reprogramming of funds for the High Technology Light Division. The FY 1984 funding increased \$58 thousand because of recalculation of project funding requirements.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

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Program Element: #62731A

Title: **Military Facilities Engineering Technology**

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

E. (U) RELATED ACTIVITIES: This program element is coordinated with the Air Force, Navy, other Army laboratories and the Joint Service Civil Engineering Research and Developing Coordinating Group. Coordination with other inter-Governmental agencies is accomplished through the Joint Services Building Materials Program with the National Bureau of Standards, participation in the National Academy of Sciences Building Research Advisory Board, and monitoring by the Directorate of Research and Development, US Army Corps of Engineers. Related programs include: Program Element #61102A (Defense Research Sciences), Project #AT23 (Basic Research in Military Construction), USA Construction Engineering Research Laboratory, Champaign, IL; Program Element #62719A (Engineering Technology (ED)), Project #AT40 (Mobility and Weapons Effects), USA Engineer Waterways Experiment Station, Vicksburg, MS; Program Element #62720A (Environmental and Life Sciences (ED)), Project #A896 (Environmental Quality Technology), USA Construction Engineering Research Laboratory, Champaign, IL; Program Element #62730A (Engineering Technology (ED)), Project #AT42 (Design Construction and Operations Technology for Cold Regions), USA Cold Regions Research and Engineering Laboratory, Hanover NH; and Program Element #62781A (Engineering Technology (ED)), Project #AT45 (Military Energy Technology), USA Construction Engineering Research Laboratory, Champaign, IL. Duplication of effort is avoided by monitoring of program elements and projects by the Directorate of Research and Development, USA Corps of Engineers (USACE); annual coordination meetings with other USACE laboratories and coordination meetings with the Air Force, Navy and other governmental agencies.

F. (U) WORK PERFORMED BY: Primary contractors for this program element include Associated Consultants, Evanston, IL; Purdue Research Foundation, West Lafayette, IN; Cognitive Systems Inc., Champaign, IL; Utah Foam Products, Salt Lake City, UT; Government Marketing Service, Rockville, MD; and the University of Illinois, Urbana, IL. Approximately 65% of the program element funds are used for in-house efforts at the USA Construction Engineering Research Laboratory, Champaign, IL.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AT41 — Military Facilities Engineering Technology: The purpose of this project is to solve problems in the life cycle of buildings and facilities which support the Army training and readiness mission. Greater productivity and economy in planning, design, construction, operation, and maintenance of Army buildings and facilities are needed to provide timely, cost-effective, and mission-responsive facilities for Army installations worldwide. FY 1982 accomplishments include: (1) a Computer-Aided Engineering and Architectural Design System for Military Construction; (2) a planning guide to assess training range requirements for multi-use by new weapons systems; (3) a pipe corrosion monitor to determine the state of corrosion in underground pipe systems without excavating; (4) a computer model to assess engineer contribution to integrated battlefield operations; and (5) rapidly erectable, inexpensive, foam plastic structures up to 50 feet in diameter for mobilization facilities. Goals in FY 1983 include: (1) quality control specification for builtup roofs; (2) management guide to aid in organization and operation of training ranges; (3) voice recognition system for automated field inspection to ensure construction quality control; and (4) ceramic anodes for cathodic protection on underground pipe systems and elevated water storage tanks. Goals for FY 1984 include: (1) an automated system for preparation and editing of military construction Project Development Brochure (PDB); (2) new materials for electromagnetic interference shielding; (3) a test kit for quality assurance testing of paints in the field.

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Program Element: #62731A

Title: Military Facilities Engineering Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62732A

Title: Remotely Piloted Vehicles (RPV) Supporting Technology

DOD Mission Area: #521 — Electronic and Physical Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	- 0 -	- 0 -	- 0 -	Continuing	Not Applicable
AF34	Remotely Piloted Vehicle Supporting Technology	- 0 -	- 0 -	- 0 -	- 0 -	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF PROGRAM ELEMENT: The objective of this program was to develop technological capabilities in those areas that currently limit the operational potential of small RPVs for Army missions or target acquisition, designation, and aerial reconnaissance, and for future missions. RPVs are required to extend the eyes of the brigade and division commanders to the range of their artillery, increase the effectiveness of their direct support firepower, and provide laser designation for laser-guided weapons. Growth capabilities, cited in the requirements document needing further development include extended range and multiple control operations. This project would have defined and developed those capabilities. Other activities included development of night and all-weather sensors, automatic cuers and intelligent bandwidth compression devices, survivability/vulnerability analysis, and study of future missions; e.g., relay, electronic support measures, and radiac survey. These exploratory development efforts would have enhanced the mission effectiveness of small RPVs, improved system reliability, and reduced life-cycle costs, wherever possible. RPV technology offers opportunities for saving lives and money on high-risk missions for pilots and aircraft.

C. (U) EXPLANATION OF CANCELLATION OR DEFERRAL: Funding of RPV growth efforts in the technology base as a separate program element was not supported by the Congress in FY 1983. Per Congressional guidance, RPV growth efforts will be funded in other program elements.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62733A

Title: Mobility Equipment Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	10601	13846	12067	13008	Continuing	Not Applicable
AH20	Mobility Equipment Technology	10601	13846	12067	13008	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The work under this program is Exploratory Development in the areas of fuel (fossil and synthetic), lubricants, power transmission fluids and corrosion-preventive coatings; mine detection and neutralization; advanced tactical barriers and related concepts; camouflage; power generation; bridging; water and wastewater management; environmental control for vans and shelters; marine equipment; containerization, construction equipment; expedient surfacing and soil stabilization; and physical security. These programs are required because of the unavailability of: field fortifications and obstacles that effectively provide the ability to economize forces, exhaust an attacking enemy, and provide adequate gain in time to prepare for offensive action; antivehicular barriers that require reduced logistical and support burdens; controllable barrier systems that effectively impede enemy units but permit safe passage of friendly forces; tunnel detection methods to recognize acoustic activity associated with underground activities; physical security data acquisition and analysis system to prevent stealing, sabotage, and espionage; tactical sensors to provide remote target-locating capability; highly competent means of standoff detection of surface-laid mines; a family of mine neutralizers for use by air and ground vehicles and in a manpack mode; sufficiently strong, advanced, lightweight mobile bridging structures for Class 60 and Class 70 bridges; highly efficient camouflage techniques for thermal decoys that provide low emissivity in the dark; rapid means for soil stabilization and emplacement of expedient surfacing; means for provision of rapid soil stabilization and emplacement of expedient surfacing; means for provision of rapid logistics-over-the-shore operations; high-efficiency fuel cell catalysts and electrodes for silent power generation; economical and effective air conditioning capabilities for combat vehicles and shelters; means for providing low vulnerability fuels to help generate significant improvement in combat survivability; detailed understanding of effects of alternate/synthetic fuels on combat vehicle operations and performance; adequate guidelines for reliable use of extended-internal oils and lubricants and re-refined oils; and highly reliable hydraulic fluids with improved fire resistance, low-temperature operational properties, and potential for economic use.

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Program Element: #62733A

Title: Mobility Equipment Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	10601	13846	12067	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	10164	11278	12717	Continuing	Not Applicable

Increase of \$437 thousand in the FY 1982 funding level is a result of reprogramming for expanded work on mine detection and neutralization. Increase of \$2568 thousand in the FY 1983 funding level is a result of reprogramming of funds for work in support of the High Technology Light Division. Reduction of \$650 thousand in the FY 1984 funding level is due to changes in scope and thrust of program tasks in the program element.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: In the fuels and lubricants technical area, active liaison and coordination is maintained with other military departments, the Environmental Protection Agency, Federal Aviation Administration, and Department of Energy. The Countermine and Barrier technical area provides direct support for Advanced and Engineering Development Program Elements: #63606A (Landmine Warfare); #63619A (Countermine and Barriers); #64619A (Landmine Warfare); and #64612A (Countermine and Barriers). The fuels and lubricants technical area provides direct support for the Advanced Development Program Element: #63104A (Fuels and Equipment). The engineer/logistics support technical area provides support for related Advanced and Engineering Program Elements: #63702A (Electric Power Sources); #63726A (Combat Support Equipment); #64714A (Tactical Electrical Power Sources); and #64717A (General Combat Support). There is no unnecessary duplication of effort within the Army or the Department of Defense related to this program area.

F. (U) WORK PERFORMED BY: In-house work is performed by US Army Mobility Equipment Research and Development Command, Ft. Belvoir, VA; US Army Engineer Waterways Experiment Station, Vicksburg, MS; US Army Tank-Automotive Command, Warren, MI; US Army Materiel Systems Analysis Agency, Aberdeen Proving Ground, MD; Natick Research and Development Command, Natick, MA. Contractual support is provided by ERIM Corp., Ann Arbor, MI; Brunswick Corp., Deland, FL; CALSPAN, Buffalo, NY; ENSCO Inc., Springfield, VA; Colorado School of Mines, Golden, CO; Hughes Aircraft, Fullerton, CA; MTIO Corp, La Thamgo, NY; Creative Tech, Scottsdale, AZ; University of Pennsylvania, Philadelphia, PA; BDM, McLean, VA.

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Program Element: #62733A

Title: Mobility Equipment Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: AH20 — Mobility Equipment Technology

a. (U) Project Description: Technology base program researching new material or improving field material which assists Army personnel in the performance of personnel and service support activities in the field: Tunnel Detection, Water Supply and Transportation, Mobility Fuels, Propulsion Systems Lubricants and Fluids, Fuels Handling, Mobility Energy and Physical Security Systems. Research and technology development in the Combat Support Engineering and Mine Warfare area are categorized as follows: Bridging, Mine Detection and Neutralization, Rapid Excavation, Protective Shelters, Tactical Deception, Mobile Electric Power and Environmental Control.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Conducted study of fatigue indicator to show service life of bridge components; completed initial concept study on feasibility of Remotely Piloted Assault Raft. The results have been forwarded to the US Army Engineer School (USAES) for statement of interest; conducted design assessments for ground-based scattermine remote detector; developed candidate systems for minefield widening and proofing; completed a mine/countermine information data base. ENERGY SYSTEMS — Improved fire-resistant fuel formulation; determined that the quantity of water in fire-resistant fuel can be reduced by 40% without affecting the self-extinguishing properties; completed a gasohol evaluation program and issued a fully coordinated gasohol specification; coordinated a draft outline with the Tank-Automotive Command (TACOM), Aviation Research and Development Command (AVRADCOM), and the Test and Evaluation Command (TECOM) to establish fully integrated Mobility Fuel and Engine RDTE Program within DARCOM; awarded contract to investigate thermally regenerative electrochemical systems. SURVIVABILITY — Conducted new technology base work in Robotic Sensors and Artificial Intelligence; actively continued to pursue countersurveillance coating efforts to defeat target acquisition and designation systems; continued to pursue new rapid excavation and overhead cover technologies for battlefield survivability. In coordination with the US Army Engineer School, continued to assist the 9th Infantry Division to generate new concepts and techniques for Rapid Deployment Joint Task Force survivability. Evaluated methodologies for development of nonlead, chromate-free anticorrosive coatings and corrosion-resistant materials to conform to toxic substance regulations and environmental regulations. Such coatings will prevent corrosion under all environmental conditions. LOGISTICS — Conducted analysis of materials-handling equipment concepts to safely outload ammunition during transition to war, initiated investigation of methods to increase payloads on 30-Ton Lighter Air Cushion Vehicle for ammunition, fuels, and lubricants in the Research and Development Joint Task Force role.

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Program Element: #62733A

Title: Mobility Equipment Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

(2) (U) FY 1983 Program: Initiate evaluation of hybrid electric power sources (fuel cell/battery) for self-propelling electric generators and as materiel-handling equipment. Perform test and integrate experimental prototype pulse power source. Initiate exploratory development of an integrated chemical-biological (CB) filter/environmental control system. Analytically evaluate a closed circuit, rapid-refueling capability for combat vehicles. Survey commercial and military refueling equipment. Fabricate and test breadboard models of mechanized pipelaying machines. Complete laboratory performance and system testing with different shale fuels. Complete feasibility evaluation for methodology in ground support equipment. Publish 1983 Army Energy Research and Development Plan. Test shale fuels in M1 tank engine. Conduct laboratory and system testing to define Fire-Resistant Fuels interface problem. Test diesel fuel stabilization with shale-derived fuels. Complete rigorous tests and conduct functional tests with nonflammable hydraulic fluid. Complete system testing of prototype long-life engine coolant. Complete field testing of ground-water detection equipment. Initiate work on an automated water quality analysis set. Scatterable minefield detection field tests are scheduled. The countermine functional area analysis will be completed. A technology that projects worldwide trends on present and future mine/countermine warfare will be completed. An analysis which identified the evolving mine threats projected to the next century will be completed. Evaluate the prototype high-speed cutting head for rapid excavation through field testing. Redesign the cutting head as required. Complete fabrication, installation, and testing of bridge component graphite-epoxy composite wound web module. Continue participation in evaluation of both organic and metal-matrix composite bridging materials. Initiate studies of field repair of aluminum and composite-material bridge structures through the application of simplified welded repair and the use of high shear strength room temperature cure adhesives. Continue evaluation of the high-stability truss chord designed and fabricated through the use of mass production textile technology. Complete design, fabrication, and testing of an organic composite component for use in bridge reinforcement systems. Brassboard multispectral camouflage concepts will be defined for stationary battlefield targets. Evaluation of radar-absorbing and radar-attenuating paints and thermal paints will continue. Evaluation of multispectral camouflage concepts to defeat visual, thermal, and radar sensors for stationary targets will be completed where possible. A system engineer study will be made of signature suppression technology and applications to evaluate the cost effectiveness of multispectral camouflage. In particular, the applications of corner reflectors will be delineated. Fabricate and evaluate subscale metal-matrix models of bridging. Set up field test sites for corrosion studies. Complete design specification for robotics locating system. Efforts will be made to incorporate advances in the state-of-the-art into the Army's physical security programs. Fabricate/evaluate materiel-handling equipment hardware concepts for transition to mobilization status.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Complete the exploratory development of thermally integrated methanol/air fuel cells. Evaluate reduced water adiabatic reformation technology. Evaluate solid state power switching elements for enhanced reliability and efficiency and reduced cost in modular power conditioners. Demonstrate pulse power generator hardware of the class needed for direct energy weapon applications. Continue exploratory development of integrated chemical-biological filter/environmental control system (ICE) to include the following complete system design. Develop control logic and type of system. Conduct laboratory performance testing on coal-derived mobility fuels. Develop specification requirements for ground fuels from shale. Conduct laboratory characterization of fuel blends from biomass conversion. Investigate potential application of broadcut/wide-boiling-range blends and other variable-quality fuel concepts. Develop water-soluble emulsifiers for Fire-Resistant Fuel. Test antimist diesel/turbine fuels. Complete functional tests with nonflammable hydraulic fluids. Conduct laboratory testing of

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Program Element: #62733A

Title: Mobility Equipment Technology

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

experimental long-life greases. Complete laboratory evaluation with candidate advanced engine coolants. Investigate an automated water quality analysis set; improved Reverse Osmosis unit/nuclear biological, chemical (NBC) capability; and groundwater detection. Airborne Minefield Detection System experimental system breadboard evaluation will be completed and progressed to Advanced Development. Demonstrate feasibility for a neutralization system capability of 3- to 5-kilometer standoff effective against hardened mines. A simulation, force-on-force combat model will be completed to simulate mine/countermine warfare. Begin development of nonstructural means, such as soil stabilization, for support of excavated walls. Continue development of high shear strength adhesives for the dual application of primary structural bridge joints and field patch repairs. Continue study of textile technology fabricated to structural members for application to advanced bridging systems. Maintain support of international programs in bridge design and application. Development of preliminary concepts for signature suppression of stationary camouflage systems will be completed. A multispectral camouflage array for a complete component of a critical system, such as a main command post or an air defense firing unit, will be built and tested. Research to develop a signature suppression system for moving area and point targets will be continued. Measurements of the electromagnetic properties of special camouflage materials will be continued. Research will continue to develop radar and thermal clutter techniques and decoys. A system engineer study will be made to evaluate the applications of radar thermal paints. Fabricate and evaluate subscale metal-matrix models of bridging components (bottom chord, king post, and tie rods) using graphite cloth as reinforcement. Initiate evaluation of environmentally acceptable chemical cleaners. All required existing solvent-based corrosion-inhibiting primers will be replaced with low-solvent-content coatings. Begin development of the robotic heavy-lift manipulator using sensing and imaging techniques. Initiate preliminary design of self-propelled artillery and tanks resupply subsystems for selected automated Ammunition Supply Points. Complete feasibility analysis of container-handling concepts.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62734A

Title: Medical Defense Against Chemical Agents

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	24080	26189	30612	33382	Continuing	Not Applicable
A875	Medical Defense Against Chemical Agents	24080	26189	30612	33382	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element is the core exploratory development technology to prevent casualties from chemical warfare (CW) agents by pharmacologic intervention of the toxic/incapacitating processes of CW agents (nerve, blister, blood). A major need exists to develop therapeutic, pretreatment, prophylactic, and antidotal compounds which neutralize lethal/incapacitating effects of ionizing radiation and CW agents. Medical materiel that insures adequate patient care and life support during evacuation and treatment, skin decontamination compounds for soldiers and patients, and patient management systems for field medical units when CW agents are used by hostile forces against our forces are significant needs addressed by this program element. Requirements are defined in the Joint Developmental Objectives Guide (JDOG) and US Army Chemical Effects Data Requirements (CEDAR).

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	24080	26189	30612	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	25785	26865	37123	Continuing	Not Applicable

The FY 1982 decrease was the result of OSD deferrals and reprogramming to higher priority Army requirements. The FY 1983 decrease is the result of pro rata application of general Congressional reductions to RDTE, A appropriation and proposed reprogramming of funds for the High Technology Light Division. The FY 1984 reduction resulted primarily from a revision of the anticipated inflation in the proposed Army budget and reprogramming to higher priority Army requirements.

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Program Element: #62734A

Title: Medical Defense Against Chemical Agents

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Program Element #61102A (Defense Research Sciences) Project #BS11 (Chemical Warfare Agent Effects and Antidotes), provides basic research support to Program Element #62734A. Advanced development efforts in Program Elements #63751A (Medical Defense Against Chemical Warfare), #63764A (Medical Chemical Defense Life Support Materiel) and engineering development efforts in PE #64757A (Medical Chemical Defense Life Support Materiel) also support Program Element #62734A. Within the Army, central management of the program on the Medical Aspects of Chemical Defense by the US Army Medical Research and Development Command is used to avoid duplication of effort. Inter-Service duplication is avoided through collaboration and coordination with the Air Force and Navy. As required of the Army as the Executive Agency for the DOD chemical defense effort, formal coordination is obtained by a Memorandum of Agreement with the Air Force and the Joint Technology Coordinating Group of the Armed Services Biomedical Research, Evaluation and Management (ASBREM) Committee. Research is also coordinated with quadripartite and NATO nations through meetings and Data Exchange Annexes.

F. (U) WORK PERFORMED BY: Approximately 48 percent of research is conducted in-house at the US Army Medical Research Institute of Chemical Defense, Aberdeen Proving Ground, MD; the US Army Research Institute of Environmental Medicine, Natick, MA; the US Army Medical Bioengineering Research and Development Laboratory, Fort Detrick, Frederick, MD; the US Army Institute for Dental Research, Washington, DC; the US Army Aeromedical Research Laboratory, Fort Rucker, AL; the Letterman Army Institute of Research, Presidio of San Francisco, CA; and the Walter Reed Army Institute of Research, Washington, DC. The remaining 52 percent is conducted under contract; the top five contractors include: Associate Consultants, Inc., Washington, DC; Battelle Columbus Laboratories, Columbus, OH; California Institute of Technology, Pasadena, CA; Los Alamos National Laboratory, Albuquerque, NM; and University of Maryland School of Medicine, Baltimore, MD. During FY 1982 \$10,433,423 was provided to 62 additional contractors to conduct research.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: A875 — Medical Defense Against Chemical Agents

a. (U) Project Description: This exploratory development project emphasizes the prevention of CW casualties through the application of drugs to interrupt and terminate the toxic processes of nerve, blister, and CW blood agents. A majority of the resources applied to this project support development of prophylactic/pre-treatment, antidotal, decontaminating, and therapeutic compounds that will neutralize lethal and performance and

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Program Element: #62734A

Title: Medical Defense Against Chemical Agents

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

behavioral decrements of CW agents and ionizing radiation. The remainder support development of medical materiel that insures adequate patient care, field resuscitation, skin decontamination of casualties and soldiers, and patient management procedures.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) **FY 1982 Accomplishments:** For the first time, a model has been developed whereby data from efficacy studies of the current nerve agent antidote can be used to evaluate potential candidates. The mode of action for specific nerve agents at selected cellular sites was determined. This information will enable researchers to develop more improved antidotes against nerve agents. Several potential pretreatment compounds for nerve agents have been submitted to preliminary evaluation. A program to evaluate the use of methemoglobin as a protective measure for cyanide poisoning has been established. The evaluation of promising antiradiation compounds continued and included a collaborative effort with the National Cancer Institute. Performance decrements caused by current nerve agent antidotes were determined in animal models. Methods and compounds for protection and treatment of blister agents were evaluated. A joint evaluation and development program for field resuscitation has been established in cooperation with the Air Force. Evaluation of the M258A1 standard skin decontamination kit has determined that the components of these kits are skin irritants. Mutagenicity and teratogenicity studies on the candidate CW agent/antidotes have been initiated. The US Army Medical Research and Development Command has assumed responsibility for all research in soldier/patient skin decontamination.

(2) (U) **FY 1983 Program:** The development of models and methodologies of prophylaxis, safety, and efficacy testing of potential anti-CW compounds will expand. The efficacy of several potential pretreatment compounds for nerve agents will be determined in animals. Emphasis will continue on development of drug testing capabilities to comply with the Federal Food and Drug Administration requirements for an Investigational New Drug Application and Good Manufacturing Practices. The evaluation of potential prophylactic and antidotal compounds will continue. The effect on performance of both antidotal compounds and CW agents will continue. The development of an antiradiation compound will be continued with the addition of new methods of formulation which prolong effectiveness of the drug. The impact of daily biorhythms and physical exercise on the effects of CW agents will be explored. The effects of candidate anti-CW compounds on sensory systems (i.e. vision, hearing) will be initiated. Exploratory development programs for new chemically protective field bandages, and medical instrumentation to determine the degree of casualty exposure to CW will be initiated. Mutagenicity and teratogenicity studies on potential pretreatment compounds will be continued. Use of commercially developed polymeric resins as a new means of skin decontamination will be explored. Innovative methods for individual lifesaving resuscitation usable by nonmedical personnel will be examined.

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Program Element: #62734A

Title: Medical Defense Against Chemical Agents

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Evaluation of compounds having potential as improved treatments for nerve agent, blister agent, and cyanide poisoning will continue in an attempt to identify compounds inducing maximum protection with minimal side effects and performance decrements. Efforts will continue on developing an effective system of chemical casualty management. Additionally, the FY 1984 program will focus on: efficacy screening of potential compounds against blister agents; exploitation of foreign materials that have potential in treatment and mediation of the effects of CW agents; studies of low-level, long-term exposure to nerve agents; examination of the interaction of CW agents and antidotal compounds on soldier behavior and performance; initiation of studies on soldier/patient decontamination material; exploratory development of robotic, noninvasive diagnostic equipment; preclinical toxicological studies on potential skin barrier creams; and evaluation of new candidate antiradiation compounds. A major effort will be initiated to develop the skin decontamination research program assumed from the Chemical Systems Laboratory.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62746A

Title: Tactical ADP Technology

DOD Mission Area: #521 — Electronic and Physical Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	7975	7056	7508	13116	Continuing	Not Applicable
A094	Tactical ADP Technology	7975	7056	7508	13116	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This project provides the technology base for new concepts and advances in technology to meet the presently unsolved problem of survivable, interoperable, cost-effective, maintainable tactical command, control, and information-handling systems for the modern battlefield. Exploratory development is performed in computer software and hardware technology toward this goal because of the unique Army security, logistical, auxiliary, and administrative automated data processing requirements. This program element contributes to major Army thrusts in Distributed Command, Control, Communications, and Intelligence (DC³).

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	7975	7056	7508	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	8029	7076	6003	Continuing	Not Applicable

Reduction of \$54 thousand in the FY 1982 funding level is a result of minor reprogramming adjustments. The funding decrease of \$20 thousand in FY 1983 is a result of pro rata application of Congressional reductions in the RDTE, A appropriation. FY 1984 increase of \$1505 thousand is attributable to expanded scope of program to include increased computer security and artificial intelligence tasks.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

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Program Element: #62746A

Title: Tactical ADP Technology

DOD Mission Area: #521 — Electronic and Physical
Sciences (ED)

Budget Activity: #1 — Technology Base

E. (U) RELATED ACTIVITIES: This program is related to all Army battlefield automation systems (BAS) as it will provide technology for a standard family of computers, software, and peripheral devices for such systems. It provides the exploratory development needed for direct support to Program Element (PE) #63723 (Command and Control Tactical Automation) and PE #64727 (Command and Control). Research and studies performed by the Air Force and Navy are also related. Coordination is accomplished by review conducted by the Department of Defense, through the exchange of technical reports, attendance at scientific meetings and conferences, and through the Joint Service Research and Development (R&D) Technology Panel of the Office of the Secretary of Defense (OSD) Management Steering Committee for Embedded Computer Resources.

F. (U) WORK PERFORMED BY: EG&G, Rockville, MD; Carnegie Mellon University, Pittsburgh, PA; Computer Sciences Corporation, Moorestown, NJ; Softech, Inc., Waltham, MA; Jersey City State College, Jersey City, NJ. In-house development performed by the US Army Communications Electronics Command, Fort Monmouth, NJ, and the Army Communicative Technology Office at Fort Eustis, VA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: A094 — Tactical ADP Technology: This project provides the necessary technology to enhance survivability, interoperability, effectiveness and reduce costs for development, maintenance and logistic support for battlefield automated systems (BAS). In FY 1982 the development of Nebula and an instruction set architecture was completed. A life cycle cost model was also developed in FY 1982. Continued Ada program design case studies and initiated internal definition of Ada/Ada Language System Training Requirements. Initiated a program to exploit artificial intelligence technology in Army Command, Control and Communications (C³) Systems. Operated the Teleprocessing Design Center in support of exploratory development. Developed Advanced Research Projects Agency Network (ARPANET) Network secure interfaces. Formulated concepts for secure operating systems for military computers. Developed CECOM Computer Resources Management Policy. In FY 1983 it is planned to: complete the development of test techniques for Military Computer Family (MCF) computers, investigate the application of Very High Speed Integrated Circuits technologies to second-generation MCF computers, develop Ada programs and systems technology for transitioning to Major Army Commands and the US Army Training and Doctrine Command, develop concepts for using artificial intelligence in C³, initiate the design of MCF secure operating systems, develop distributed processing techniques for physically dispersed systems, develop firmware standardization policies and continue to operate the Teleprocessing Design Center in support of exploratory development. In FY 1984 plans call for: initiating an investigation of enhancements to Nebula for second-generation MCF, continuing Ada curriculum development to include computer-aided instruction, beginning experiments with artificial intelligence, developing and demonstrating distributed processing techniques for inclusion into Army battlefield automated systems, updating Computer Resources Management policies and techniques and operating the Teleprocessing Design Center for exploratory development.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62770A

Title: Military Disease Hazards Technology

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	18139	23646	24828	23629	Continuing	Not Applicable
A870	Risk Assessment of Military Disease Hazards	3765	4836	- 0 -	- 0 -		
A870	DOD Medical Defense Against Infectious Diseases	- 0 -	- 0 -	14099	12406	Continuing	Not Applicable
A871	Prevention of Military Disease Hazards	14374	18810	- 0 -	- 0 -		
A871	Medical Defense Against Biological Warfare	- 0 -	- 0 -	10729	11223	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element is the core DOD exploratory development program for exploiting strategies to control parasitic, bacterial, and viral diseases of military importance and for developing an effective medical defense against biological weapons. It is part of the Army thrust in biotechnology. These strategies include the development of systems of vaccines, drugs, repellents, and antitoxins. Requirements for this research are identified by the Combat Service Support Mission Area Analysis (level II), the Scientific and Technology Objective Guide, and Air-Land Battle 2000 doctrine.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	18139	23646	24828	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	17115	24979	29805	Continuing	Not Applicable

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Program Element: #62770A

Title: **Military Disease Hazards Technology**

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

The FY 1982 increase is due to reprogramming to this higher priority project. The FY 1983 decrease is the result of Congressionally directed reduction of \$1267 thousand and pro rata application of general Congressional reductions to RDTEA appropriation. The FY 1984 decrease is the result of reprogramming to a higher Army priority and of a revision to the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program element is an integral part of the DOD medical research and development effort. It bridges the science base in Program Element #61102A (Defense Research Sciences, Army), Project BS10 (Military Disease Hazards Research), and Project BS12 (Science Base/Medical Defense Against Biological Warfare (BW), and the production of items supported by Program Element 63750A (Drug and Vaccine Development), Project D808 (DOD Drug and Vaccine Development), and Project D809 (Drug and Vaccine Development/Medical Defense Against BW). At the direction of the Congress, Army and Navy infectious disease research efforts were consolidated in FY 1982 into a single DOD program with the Army designated lead agent and responsible for planning, programming, and budgeting for the DOD infectious disease program. Navy scientists will continue to participate in the execution of the program. The consolidation plan will prevent any duplication of effort between the two Services.

F. (U) WORK PERFORMED BY: Approximately 72 percent of the research is performed by in-house laboratories at the Walter Reed Army Institute of Research, Washington, DC, and field units in Thailand, Malaysia, Brazil, and Kenya; the US Army Medical Research Institute of Infectious Diseases, Fort Detrick, Frederick, MD; the US Army Medical Bioengineering Research and Development Laboratory, Fort Detrick, Frederick, MD; and the Letterman Army Institute of Research, Presidio of San Francisco, CA. The Naval Medical Research Institute, Bethesda, MD, and the Naval Health Research Center, San Diego, CA, and Naval field units in Egypt, Indonesia, and the Philippines conduct infectious disease research under Army program management. The remaining research is conducted under contracts with nonprofit organizations, universities, and industries. The five major contracts are those with the University of Illinois, Urbana, IL; Institute for Medical Research, Kuala Lumpur, Malaysia; University of Miami, Miami, FL; Hazleton Laboratories America, Inc., Vienna, VA; and Warner-Lambert Co., Detroit, MI. Forty other contractors are funded in the amount of \$3,542,695.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: A870 — DOD Medical Defense Against Infectious Diseases:

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Program Element: #62770A

Title: Military Disease Hazards Technology

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

a. (U) **Project Description:** This project is designed to explore development technologies for prevention and treatment of infectious diseases of military importance. Work is performed on those serious diseases that have occurred repeatedly as epidemics during mobilization and deployment of military forces. Studies are conducted on a wide range of disease-producing microorganisms and on insect and other arthropod vectors of disease.

b. (U) **Program Accomplishments and Future Efforts:**

(1) (U) **FY 1982 Accomplishments:** Improved diagnostic techniques for dengue and hepatitis, two serious military disease hazards, were developed. The primary mosquito vector of human malaria in Southeast Asia was described, thus enabling field units to better assess the risk of malaria and institute more appropriate control measures. A new delivery system that targets drugs to the specific organs infected will dramatically improve the treatment of leishmaniasis, an incapacitating disease found in the tropics, by increasing the dose to the parasite while avoiding toxic effects to the patient. New substances which may be useful as malaria vaccines have been isolated and identified using highly specific monoclonal antibody technology. A major technological breakthrough permits combination of genetic material from dysentery organisms with nondisease-producing typhoid strains to produce a new kind of oral vaccine that immunizes against both diseases.

(2) (U) **FY 1983 Program:** Emphasis will be placed on medical applications of biotechnology; i.e., the application of gene transfer and monoclonal antibody research to infectious disease research. Testing of new antileishmanial drugs and new delivery systems for these drugs will continue. Vaccines are currently being developed for three of the four distinct dengue types, and this year several isolates of the remaining type will be tested for their suitability as a vaccine strain. The genetic technology that enabled a new oral typhoid-dysentery vaccine will be applied to other diarrhea-causing organisms.

(3) (U) **FY 1984 Planned Program and Basis for Budget Year Request:** Emphasis on biotechnology to meet Army requirements for new protective and treatment measures against infectious diseases will increase. Evaluation of new organ-specific drug delivery systems to overcome the toxicity of antiparasitic drugs will be directed to leishmaniasis, malaria, trypanosomiasis, and schistosomiasis. Exploratory development of candidate malaria vaccines will continue. Research will continue on developing rapid field tests for the diagnosis of infections impairing deployment.

(4) (U) **Program to Completion:** This is a continuing program.

c. (U) **Major Milestones:** Not Applicable.

2. (U) **Project A671 — Medical Defense Against Biological Warfare (BW):**

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Program Element: #62770A

Title: **Military Disease Hazards Technology**

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

a. (U) **Project Description:** This project includes tasks that are designed to develop an effective medical defense against known and potential biological warfare agents. Priority is placed on designing methods and procedures to identify and diagnose the biological warfare (BW) agents/diseases in the shortest period of time and developing medical countermeasures against biological toxins.

b. (U) **Program Accomplishments and Future Efforts:**

(1) (U) **FY 1982 Accomplishments:** The Food and Drug Administration (FDA) approved use of human antitoxin plasma developed in this program for treatment of botulism, a usually fatal disease when untreated, that has high potential as a biological weapon. Development began on vaccines for hemorrhagic fever viruses, possible BW or natural disease threats to deployed forces. Screening of new antiviral drugs was initiated against a number of potential BW viruses.

(2) (U) **FY 1983 Program:** Biotechnology, one of the Army's new research thrust areas, will continue to be applied to as many efforts as practicable. For instance, highly specific monoclonal antibodies are being developed that should allow more sensitive techniques for viral detection from field-collected insect and other arthropod vectors and animal reservoirs. Research on two options for an anthrax vaccine will enable the selection of a candidate vaccine for field development.

(3) (U) **FY 1984 Planned Program and Basis for Budget Year Request:** Efforts will increase in using biotechnology to create new defensive measures against BW. The screening of new antiviral drugs will continue with testing directed against high-hazard viruses. Monoclonal antibodies will be used to selectively identify specific antigens from aerosols, an important step since a biological weapon will likely be disseminated as an aerosol.

(4) (U) **Program to Completion:** This is a continuing program.

c. (U) **Major Milestones:** Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62772A

Title: Combat Casualty Care Technology

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	6501	6663	7136	8591	Continuing	Not Applicable
A874	Care of the Combat Casualty	6501	6663	7136	8591	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element specifically addresses military ballistic injury, shock resulting from blood loss and infection, burns resulting from military weapons systems with particular attention to burn inhalation injury, superblast overpressure injury as it affects lung and intestinal tract, the development of safe oxygen-carrying resuscitative fluids (field-usable blood substitutes), blood preservation systems specifically addressing Army needs, and investigation of new technology in the field of medical materiel which will reduce Army logistical and manpower requirements. Research requirements are identified by Level II Mission Area Analysis, Combat Service Support, Medical, the Science and Technology Objectives Guide (STOG) and the doctrine of Air-Land Battle 2000. Improved methods of treatment and management of battlefield casualties will reduce and limit disability and death from conventional and nonconventional weapon systems.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	6501	6663	7136	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	6749	6662	8486	Continuing	Not Applicable

The FY 1982 decrease was a result of technology base reprioritization by the Office of the Deputy Chief of Staff for Research, Development, and Acquisition (ODCSRDA). The FY 1983 decrease is the result of pro rata application of general Congressional reductions to RDTE, A appropriation. The FY 1984 reduction is the result of reprogramming to higher priority Army requirements and a revision to the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #62772A

Title: Combat Casualty Care Technology

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program contains, in part, items and systems that will progress to advanced and engineering development in related Program Elements #63732A (Combat Medical Materiel) and #64717A (General Combat Support), respectively; related science bases in physiology, biochemistry, physics, pharmacology, microbiology, chemistry, toxicology, pathology, and neurological sciences are provided under Program Element #61102A/Project BS10 (Research on Military Diseases, Injury, and Health Hazards). Coordination is effected with the Navy, Air Force, Uniformed Services University of the Health Sciences, National Institutes of Health, and with other Federal agencies by the Joint Technology Coordinating Group for Combat Casualty Care (JTCCG/C³) through the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee. Complete annual programmatic review in combat casualty care and monthly liaison meetings by the Joint Technology Coordinating Group for Combat Casualty Care insures nonduplication of effort, identifies complementary areas of research, and provides the mechanism for inter-service laboratory utilization and coordination.

F. (U) WORK PERFORMED BY: Sixty-five percent of work in this program element is performed in-house at the Letterman Army Institute of Research (LAIR), Presidio of San Francisco, CA; the US Army Medical Bioengineering Research and Development Laboratory (USAMBRDL), Ft. Detrick, MD; the Institute of Surgical Research (ISR), San Antonio, TX; and the Walter Reed Army Institute of Research (WRAIR), Washington, DC. Major extramural contracts are with Albert Einstein University, Bronx, NY; University of Wisconsin, Madison, WI; Washington University, St. Louis, MO; University of Washington, Seattle, WA; and Farber Cancer Institute, Boston, MA. Thirty-three additional contractors with contracts totaling \$1,735,883 support this effort.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: A874 — Care of the Combat Casualty: This project finances the core technology base to develop concepts, techniques, and materiel for the treatment of soldiers wounded in combat and is required to reduce disability and death from both conventional and nonconventional weapons. During FY 1982, accomplishments were: development of a facility to study nonlaser ocular injuries and eyes penetrated by fragments; data for a preservative extending the shelf life of whole blood to 42 days were submitted to the Bureau of Biologics (Food and Drug Administration) for approval; preliminary efficacy and safety studies were completed on Stroma-Free Hemoglobin (SFH), an oxygen-carrying resuscitative fluid that can partially substitute for whole blood (this item is expected to move to advanced development in FY 1984.) The nature of wounds from ultra-high velocity missiles (simulating cluster bomb fragments) were characterized; several different wound dressings were evaluated for use in delayed evacuation scenarios; and an improved autotransfusion device to conserve blood in combat was evaluated. The principal thrusts of the FY 1983 Program and FY 1984 Planned Program are: evaluation of field-usable anesthetic techniques; development of measures to prevent or minimize deterioration of the physiological and biochemical disturbances contributing to shock and develop countermeasures; selection of the optimum modification of SFH for pilot plant industrial production; development of blood and blood product preservation systems with indefinite unrefrigerated shelf life; characterization of nonlaser ocular injuries; continuation of clinical evaluation of treatment of serious burn wounds with specific

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Program Element: #62772A

Title: Combat Casualty Care Technology

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

attention to inhalation injury; initiation of pilot studies in blast overpressure injury; and investigation of alternatives for field production of medical-grade oxygen and water.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62775A

Title: Combat Maxillofacial Injury

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1510	2017	2505	2912	Continuing	Not Applicable
A825	DOD Combat Dentistry	1510	2017	2505	2912	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element is the core Department of Defense exploratory technology base to develop the methods and materials for prevention and treatment management of combat maxillofacial (face and neck) injuries; included is the development of equipment and materials required to provide essential dental treatment in the combat environment. Research requirements are identified by Level II Mission Area Analysis, Combat Service Support, Medical; Army and Navy Science and Technology Objective Guides, and the doctrine for Air-land Battle 2000.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	1510	2017	2505	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	1473	2619	3044	Continuing	Not Applicable

The funding increase in FY 1982 was the result of reprogramming for a higher priority requirement. The funding increase from FY 1982 to FY 1983 is the result of Congressionally directed consolidation of combat dentistry research by the Army and the Navy. The funding decrease in FY 1983 is the result of Congressionally directed reduction of \$597 thousand and pro rata application of general Congressional reductions to the RDTE, A appropriation. The funding decrease in FY 1984 is a result of reprogramming to higher priority requirements and of revision to the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #62775A

Title: Combat Maxillofacial Injury

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Related basic research efforts are conducted under Program Element #61102A (Defense Research Sciences), Project #BS10 (Research on Military Disease, Injury, and Health Hazards). The Army, by Congressional directive, is the lead agency for combat dentistry research and coordinates Army and Navy efforts in these subjects under a consolidation plan approved on 2 August 1982 by the Deputy Under Secretary of Defense for Research and Engineering (Research and Advanced Technology). No other agency within the Department of Defense conducts research on these subjects. The Army Research Area Manager, through membership status and liaison meetings, achieves coordination with the National Institute of Dental Research and National Advisory Dental Research Council to preclude duplication of effort with other Federal agencies and the civilian sector.

F. (U) WORK PERFORMED BY: In-house developing organizations are the US Army Institute of Dental Research, Washington, DC, and the Naval Medical Research and Development Command, Bethesda, MD. The top five contractors are: Battelle Memorial Institute, Columbus, OH; University of Connecticut, Farmington, CT; National Bureau of Standards, US Department of Commerce, Washington, DC; Harry Diamond Laboratories, US Army Electronics Research and Development Command, Adelphi, MD; and the Franklin Institute, Philadelphia, PA. During FY 1982, \$108,561 was provided to three additional contractors to conduct research in this program.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: A825 — DOD Combat Dentistry: This project is the Department of Defense exploratory development technology base. Its major thrusts are: (1) protection of the face and neck area to reduce the incidence and severity of injuries; (2) development of new/improved methods and materials for rapid, simplified treatment of face and neck wounds; and (3) development of new/improved methods, materials, and equipment to provide dental treatment in the field. Examples of accomplishments during FY 1982 are: demonstration that high-pressure oxygen therapy reduced infection in experimental face and neck wounds; clinical trials of permanent surgical tooth implants; demonstration that sterilization of polymer implant materials by irradiation was feasible; incorporation of antiseptic and analgesic agents into a second-generation nonwoven polymer fabric dressing material; and demonstration that microencapsulated antibiotic can provide effective control of infection at wound sites. In FY 1983 and FY 1984, efforts will be in: investigations of approaches for protection of the face and neck area in combat; further clinical evaluation of ceramic surgical tooth implants; development of ceramic and polymer implant materials for face and neck wound repair; evaluation of freeze-dried, vascular and nonvascular bone grafts, staple bone implants, soft tissue grafts with irradiated and artificial skins, and microsurgical techniques for repair of face and neck wounds; development and evaluation of microencapsulated antibiotics and anesthetics for face and neck wound infection and pain control; and evaluations of the storage stability and clinical suitability of dental materials for field use. In addition, a new alternative method for preparation of bone for facial bone grafts will be initiated. Experimental prototypes of a field dental operating unit and miniaturized X-ray apparatus will be completed.

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Program Element: #62775A

Title: Combat Maxillofacial Injury

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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DESCRIPTIVE SUMMARIES OF THE RESEARCH DEVELOPMENT TEST
& EVALUATION ARMY..(U) DEPUTY CHIEF OF STAFF FOR
RESEARCH DEVELOPMENT AND ACQUISITIO.. FEB 83

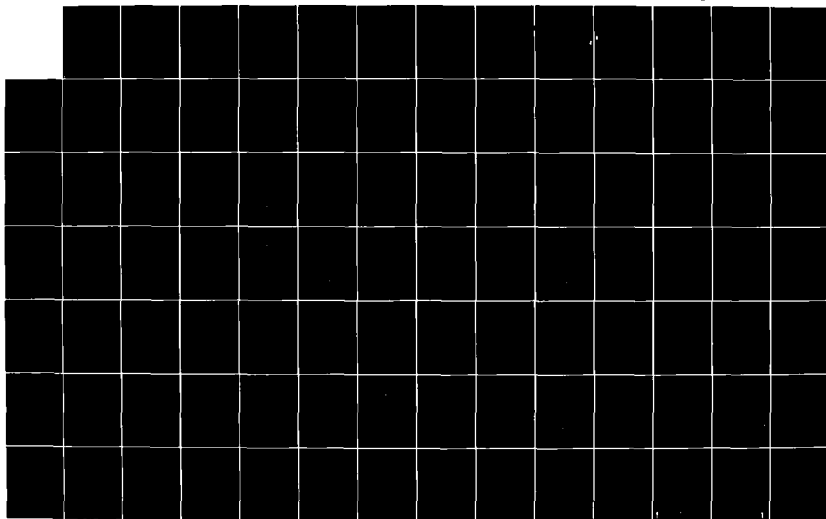
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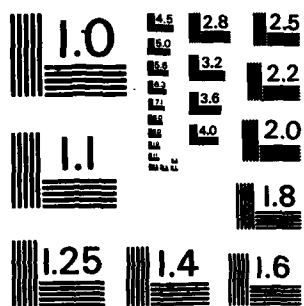
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MICROCOPY RESOLUTION TEST CHART
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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62777A

Title: Systems Health Hazard Prevention Technology

DOD Mission Area: #522 -- Environmental and Life Sciences (ED)

Budget Activity: #1 -- Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	13881	16454	17808	18535	Continuing	Not Applicable
A878	Health Hazards of Military Materiel	7306	9862	9771	10152	Continuing	Not Applicable
A879	Medical Factors Enhancing Soldier Effectiveness	6575	6592	8037	8383	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element supports the core Army exploratory development effort to determine the impact of high-technology military systems (weapon and materiel systems) and combat operations on the health and performance of soldiers. Principal thrusts focus on the health hazards of military materiel (especially mechanical forces, directed energy, and toxic hazards) and medical factors to enhance soldier effectiveness, during rapid deployment and sustained operations. Research also addresses the health status of civilian workers engaged in the production of military-unique chemical compounds. Research findings provide essential input required for health hazard assessments of developmental weapon systems; materiel design and medical standards, testing and evaluation of materiel systems, combat scenarios, doctrine, and policy development. Research requirements are identified by Level II Mission Area Analysis Combat Service Support, Medical; the Science and Technology Objectives Guide (STOG); and the doctrine of Air-land Battle 2000.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current funding)	13881	16454	17808	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	13963	18066	21365	Continuing	Not Applicable

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Program Element: #62777A

Title: Systems Health Hazard Prevention Technology

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

The FY 1982 decrease is the result of reprogramming to higher priority Army efforts. The FY 1983 decrease is the result of Congressionally directed decrements and a pro rata application of Congressional reductions to RDTEA appropriation. The FY 1984 decrease is the result of programming to higher Army priorities and of a revision to the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Toxic chemical hazard assessment is complemented by Program Element #61102/BS04 (Identification and Health Effects of Military Pollutants) and #62720A/A835 (Military Medical Environmental Quality). Basic science research is performed under Program Element #61102A/BS10 (Research on Military Disease, Injury, and Health Hazards). Technology transfer, research coordination and collaboration, and avoidance of duplication of effort is achieved through intra-Army and tri-Service agreements and regulations. In addition, formal committees such as the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee — Joint Technology Coordinating Group for Systems Biotechnology; the Tri-Service Aeromedical Research Panel (TARP); the Tri-Service Electromagnetic Radiation Panel (TERP); NATO's Advisory Group for Aerospace Research and Development; NATO Ad Hoc Working Group on Biomedical Aspects of Continuous Land Combat; US Army War College, Liaison on Unit Cohesion, Continuous Operations, and Military Stress; Skills Requirement Action Planning Group, US Army Training and Doctrine Command; and the Human Dimensions Joint Working Group, Soldier Support Center, ensure collaborative research efforts and prevent duplication. Memorandums of Understanding exist between the US Army Medical Research and Development Command (USAMRDC), the US Army Human Engineering Laboratory, the US Army Research Institute for the Behavioral and Social Sciences, and the Canadian Defence and Civil Institute of Environmental Medicine. A formal facility use agreement is maintained between the Army and the Bureau of Radiological Health, Environmental Protection Agency, and the Armed Forces Radiology Research Institute.

F. (U) WORK PERFORMED BY: Approximately 73 percent of the research within this program element is performed in-house, therefore the remaining 27 percent is conducted under contract. In-house research is performed by the US Army Aeromedical Research Laboratory, Fort Rucker, AL; Letterman Army Institute of Research, Presidio of San Francisco, CA; Walter Reed Army Institute of Research, Washington, DC; US Army Medical Bioengineering Research and Development Laboratory, Fort Detrick, Frederick, MD; US Army Research Institute of Environmental Medicine, Natick, MA. The top five contractors include: USEPA Health Effects Research Laboratory, Research Triangle Park, NC; University of Texas at Dallas, Dallas, TX; University of Massachusetts, Amherst, MA; National Center for Toxicological Research, Jefferson, AR; Lovelace Biomedical Environmental Research Institute, Inc., Albuquerque, NM. During FY 1982, \$2,000,437 was provided to 37 additional contractors to conduct research in this program.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

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Program Element: #62777A

Title: Systems Health Hazard Prevention Technology

DOD Mission Area: #522 — Environmental and Life Sciences (ED)

Budget Activity: #1 — Technology Base

1. (U) A878 — Health Hazards of Military Materiel: Project objectives focus on the determination and definition of human health threats or stressors that are generated by military systems. Adverse medical stressors considered in this area of research are: (a) inherent in the engineering design of a weapon system; (b) a primary function of military operations/training; and (c) environmental threats to soldiers in training and combat. Specific stresses include steady state noise, vibration, and impact damage incurred from armored vehicles, helicopters, and various types of equipment; blast overpressure and impulse noise injury generated by blast-producing weapon systems; heat stress induced by wearing chemical-protective ensembles; toxic gas exposures to soldiers operating in combat crew compartments; and the bioeffects of whole-body laser exposures. The primary research effort is directed toward: (1) identification and quantification of various stressors; (2) development of energy-injury or dose-response relationships; (3) development of recommended exposure criteria; and (4) predictive modeling. Research requirements are identified in Mission Area Analyses, Army threat analyses, the Science and Technology Objectives Guide, materiel requirements, and analysis of the Air-land Battle 2000 doctrine. During FY 1982, human tolerance biophysical evaluations of candidate materials for various uniform systems (to include CW ensembles), sleeping bags, and footwear were conducted in support of (DARCOM) developers. A mathematical model was developed to predict injury to the throat and lungs as a function of the magnitude and duration of the peak blast pressure produced by a weapon system. The effects of toxic gas exposures on health were assessed in the HELLFIRE-equipped UH-60 helicopter. It was demonstrated that for the relationship between ocular lens injury and microwave power levels, the critical variable is energy per pulse rather than total exposure and that the mechanism of tissue damage is primarily thermoacoustic expansion, which can be produced by power levels well within current microwave exposure standards. Both laboratory and field tests were conducted to evaluate the effects upon target acquisition and identification of introducing various laser-protective materials into the optical systems of armored vehicles and antitank weapons. The FY 1983 program includes study of plasma volume expansion techniques to expedite human adaptation to hot environments. The effects of combat vehicle vibration on operator fatigue, performance, perception of spatial orientation, and visual acuity will be evaluated. Definition of hazards attributable to significant parameters of micro/millimeter wave radiation: to include frequency, power level, polarization, and modulation will continue. Field studies will be initiated to assess the impact of non laser eye protection devices (filters) on live fire performance and target tracking performance. The FY 1984 planned program includes research efforts to define human tolerance limits and determine performance decrements incurred by wearing various protective clothing ensembles while operating within vehicle combat crew compartments. Blast overpressure research will focus on the mechanisms of auditory injury, pulmonary and gastrointestinal injury, and development of attenuation measures for new weapon systems. These actions are necessary to validate blast overpressure models for predicting health hazard risks, and to ensure that sufficient data are available early in the system development process to define human risks associated with the design. Exploratory development of individual protection devices against directed energy weapons will continue; in addition, biomedical data bases will be established relative to laser and micro/millimeter wave weapons as outlined in the Army's Directed Energy Weapon Action Plan (Draft). Inhalation toxicology and health hazard assessment studies on inventory and developmental smokes and obscurants will continue in support of the DARCOM Program Manager for Smoke/Obscurants. A comprehensive problem definition study will continue on field water supply and sanitation, including doctrine needs and health protection criteria for toxic contaminants, biological pathogens, radiological substances, and associated chemical agent hazards.

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Program Element: #62777A

Title: Systems Health Hazard Prevention Technology

DOD Mission Area: #622 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

2. (U) A879 — Medical Factors Enhancing Soldier Effectiveness: Research objectives in this project area are principally directed toward the physiological, social, and psychological mechanisms underlying behavioral and performance requirements imposed by military systems and combat operations. The primary emphasis is to prevent casualties by defining: (a) factors which predispose the individual soldier to ineffectiveness because of inadequate physical capacity or training, indoctrination, and personal adjustment, and (b) the mechanisms by which increased stress imposed by harsh environmental extremes, complex and exhausting performance demands, and life-threatening risks exceed human tolerance. Neuropsychiatric and physiological investigations are conducted to identify and quantify environmental and operational stresses and develop dose-response relationships between specific stresses and soldier tolerance and survivability. Overall thrust areas include: (a) medical techniques relative to artificial intelligence/robotics; (b) combat psychiatry; and (c) combat crew effectiveness. Research requirements are identified in Mission Area Analyses, Army threat analyses, the Science and Technology Objectives Guide, materiel requirements documents, and the Air-land Battle 2000 doctrine. During FY 1982, studies conducted with families of soldiers in the 82nd Airborne Division assigned to the Sinai peace-keeping force determined that those most vulnerable to morale and health status problems were lower ranking enlisted families of E5 and below. In support of the Women in the Army Policy Review Group, gender-free physical capacity test measures related to military occupational specialties were refined, and a validation of these test items initiated for use at the Military Entrance Processing Station. Research on heat resulted in the publication of Department of the Army Circular 40-82-3, "Prevention of Heat Injury," and the Army-wide distribution of a personal card to each soldier outlining guidance on water intake and work-rest cycles in hot/wet and hot/dry field conditions. Mathematical equations for modeling sweat loss resulting from exercise, environment, and clothing were developed, refined, and validated for the prediction of heat illness. Collaborative efforts in stress research resulted in the publication of a Department of the Army Pamphlet entitled "Training, Developing, and Maintaining Unit Cohesion," and draft manuals entitled "Management of Stress in Army Operations" and "Soldier Performance in Continuous Operations." The FY 1983/84 planned program will include two new efforts: (a) Artificial Intelligence/Robotics efforts directed toward developing a near-term prototype demonstrator for remote sensing of vital medical information; and (b) Military Nutrition and Soldier Performance will focus on a collaborative performance evaluation of the Meal, Ready to Eat (MRE) with Natick Laboratories and heat stress assessment of the replacement fluid for soldiers operating in chemical protective ensemble. Factors will be identified within military organizational structures and environments that lead to decrements in personnel performance, dysfunctional behavior, and psychiatric casualties. The relationships between severe stress, the individual, the small military unit, and the larger organizational military environment will be examined. Strategies will be developed for use by command leadership and medical personnel to enhance unit cohesion. Research will continue to assess the impact of the COHORT (cohesive operational readiness training) program and regimental system on the health and morale of soldiers. Recommendations to prevent heat illness, based on the evaluation of water consumption factors and work-rest cycles, will be provided for the Rapid Deployment Force and military units engaged in desert operations. Physical fitness test items, related to the prediction of successful performance in military occupational specialties, will be validated in field studies. Training-induced orthopedic injuries will be analyzed as a function of footwear and training technique. Biomedical criteria for crew selection and retention standards will be developed with emphasis on visual, auditory, pulmonary, and dynamic strength standards.

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Program Element: #62777A

Title: Systems Health Hazard Prevention Technology

DOD Mission Area: #522 — Environmental and Life
Sciences (ED)

Budget Activity: #1 — Technology Base

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #62781A

Title: Energy Technology Applied to Military Facilities

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2032	1886	1900	2251	Continuing	Not Applicable
AT45	Energy Technology Applied to Military Facilities	2032	1886	1900	2251	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEEDED: The annual energy cost to operate Army installations is \$1.3 billion. This is 84 percent of all energy used by the Army for vehicles, aircraft, training activities, and facility heating, ventilation, and cooling. This program provides technologies to reduce Army facilities' energy consumption. Technologies developed by the Department of Energy and the private sector are being adapted to satisfy Army needs for reliable, cost effective energy systems to support the training and readiness missions of the Army. Problems being addressed include design methods to provide thermally efficient new facilities, rehabilitation and retrofit methodology for existing facilities, management techniques for energy-efficient operation of existing and new facilities, and methods to provide for the use of alternate fuels to replace high-cost petroleum-based fuels.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2032	1886	1900	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	1877	1891	2102	Continuing	Not Applicable

The increase of \$55 thousand in the FY 1982 funding level is a result of reprogramming to provide funding for a Defense Small Business Advanced Technology project. The decrease of \$5 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTEA appropriation. A reduction of \$202 thousand in FY 1984 is a result of reprogramming to higher priority programs and new thrusts.

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Program Element: #62781A

Title: Energy Technology Applied to Military Facilities

DOD Mission Area: #523 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program is coordinated with the Air Force, Navy, and the Department of Energy (DOE). The Army, Air Force, and Navy participate in the the Joint Services Civil Engineering Research and Development Coordinating Group. This group provides a forum for development of joint programs and to ensure that there is no duplication of effort between the Services. Workshops with the Department of Energy provide the opportunity for exchange of information and status reports on DOE research that may be appropriate for application to Army energy problems. Related research and development projects are: Program Element #61102A (Defense Research Sciences), Project #AT23 (Basic Research in Military Construction), USA Construction Engineering Research Laboratory, Champaign, IL; Program Element #62731A (Military Facilities Engineering Technology), Project #AT41 (Military Facilities Engineering Technology), USA Construction Engineering Research Laboratory, Champaign, IL; Program Element #62720A (Environmental Quality Technology), Project #A896 (Environmental Quality Technology), USA Construction Engineering Research Laboratory, Champaign, IL; and Program Element #63734A (Military Engineering Technology), Project #DT09 (Energy Systems Tests), USA Construction Engineering Research Laboratory, Champaign, IL.

F. (U) WORK PERFORMED BY: Primary Contractors for this program element include GARD Inc, Chicago, IL; Hagler, Bailly and Associates, Washington DC; and the University of Illinois, Urbana, IL. Approximately 65% of the project funds are used for in-house efforts at the USA Construction Engineering Research Laboratory with participation by the USA Facility Engineer Support Agency, Ft. Belvoir, VA; and the USA Cold Regions Research and Engineering Laboratory, Hanover, NH.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: AT45 — Energy Technology Applied to Military Facilities: The purpose of this research project is to provide the Army with technologies to: design energy-efficient new facilities; upgrade existing facilities to conserve energy; efficiently operate building heating, cooling, ventilating, and lighting systems; and substitute efficient and economical alternative fuels for high-cost petroleum-based fuels. Accomplishments in FY 1982 included: retrofit alternatives for standard designs of barracks, battalion headquarters, enlisted personnel dining halls and motor repair shops; application and maintenance procedures for electronic time switches in facilities to control energy use; and procedures and instrumentation for final acceptance of solar energy systems. Goals for FY 1983 include: Procedures for reviewing facilities designs for energy effectiveness, diagnostic techniques for energy acceptance testing of new construction, forecast of facilities energy source availability and expected costs to the year 2000, and improved planning and design guidance through performance analysis of installed Army solar energy systems. The FY 1984 goals are: Micro computer energy analysis methods for new construction; retrofit alternatives for improving the performance of existing heating, ventilating, and air conditioning controls; industrial facilities energy impact analysis procedures to support mobilization planning; alternative fuels selection criteria; and methodology for use of energy storage technology in operation of facilities.

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Program Element: #62781A

Title: Energy Technology Applied to Military Facilities

DOD Mission Area: #623 — Engineering Technology (ED)

Budget Activity: #1 — Technology Base

HL (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63102A

Title: Materials and Structures Advanced Development

DOD Mission Area: #563 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	4736	6460	12341	20355	Continuing	Not Applicable
D071	Materials Scale-Up	4736	6460	5792	7887	Continuing	Not Applicable
D077	Materials Processing AD	- 0 -	- 0 -	3601	5756	Continuing	Not Applicable
D085	Producibility/Reliability	- 0 -	- 0 -	1240	3664	Continuing	Not Applicable
D081	Specifications and Standards	- 0 -	- 0 -	1708	3048	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Work in this program element is in support of specific Army mission needs: scaled-up advanced, heavy armor for ground combat vehicles combining capabilities for effective defense against Soviet penetrator munition threats and to provide 30 to 70 percent reduced weight to maximize ground mobility and allow for rapid deployment; computerized fabrication of composite rotor blades for 35% reduction in blade cost for CH-47D, AAH, and UH-60-type helicopters; producibility and reliability methods for rapid, low-cost thermal treatment in fabrication of M-774 and M833-type long-rod penetrator munitions; and new technical data packages for advanced elastomers for M1 tank track pads. Current Army weapon systems development is limited by problems that arise from a lack of adequate demonstration and validation of scalability and processing of advanced structural materials. Work in this Program Element will be used to transfer new and improved materials into Army advanced weapon systems through the following sequence: (1) Materials Scale-up will demonstrate that desired properties of advanced materials are scalable; Materials Processing Advanced Development will evaluate optional processing procedures to find the most effective and economical method for fabricating components; Producibility/Reliability Advanced Development will develop, perfect, and assess methods for reliably fabricating components so that superior properties are reproducibly retained in finished products; Specifications and Standards Advanced Development provides Technical Data Packages describing in detail the processing procedures and parameters for application of advanced materials in Army weapon systems.

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Program Element: #63102A

Title: Materials and Structures Advanced Development

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	4736	6460	12341	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	3986	7478	16061	Continuing	Not Applicable

Increase of \$750 thousand in FY 1982 is a result of reprogramming to begin scale-up of advanced compartmental armor materials for ground combat vehicles. The funding decrease of \$1018 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act, and a pro rata application of general Congressional reductions to the RDTE,A appropriation. Decrease of \$3720 thousand in FY 1984 primarily reflects reduction in FY 1984 Army Industrial Fund rate structure and program element realignment and restructuring.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The Air Force, Navy, other Government agencies, and allied nations have analogous programs. Although similar in approach, these programs differ greatly in emphasis placed on materials advanced development for specific hardware applications. Coordination within the Department of Defense is achieved through the Office of the Deputy Under Secretary of Defense for Research and Engineering's Apportionment Reviews and Ad Hoc Services Materials Laboratories Council meetings. Coordination with the nonmilitary federal agencies is effected through participation in activities of the National Materials Advisory Board of the National Academy of Sciences — National Academy of Engineering, and the Federal Council on Science and Technology - Committee on Materials. International coordination is effected through participation in the Technical Cooperation Program with Australia, Canada, New Zealand, and the United Kingdom, and the Structures and Materials Panel of the Advisory Group for Aerospace Research and Development of the North Atlantic Treaty Organization. Related efforts are Program Element #61101A (In-House Laboratory Independent Research); Project #A91A, same title; Program Element #61102A (Defense Research Science), Project #AH42 (Materials and Mechanics); and Program Element #62105A (Materials), Project #AH84, same title. These program elements and projects reflect the Research and Exploratory Development from which emerge the materials and materials data on which this program element is based. There is no unnecessary duplication of effort within the Army or Department of Defense in this program area.

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Program Element: #63102A

Title: Materials and Structures Advanced Development

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

F. (U) WORK PERFORMED BY: Approximately 47 percent of the effort will be accomplished in-house at the US Army Materials Research Center, Watertown, MA; US Army Mobility Equipment Research and Development Command, Fort Belvoir, VA; US Army Armament Research and Development Command, Dover, NJ; US Army Aviation Research and Development Command, Ft. Belvoir and Fort Eustis, VA; and US Army Missile Command, Redstone Arsenal, AL. The top five contractors are: AVCO Specialty Materials Div., Lowell, MA; Boeing Vertol, Philadelphia, PA; Doloway/Webb Associates, Chatsworth, CA; Materials Concepts Incorporated, Columbus, OH; Georgia Institute of Technology, Atlanta, GA. There are anticipated eleven additional contracts totaling \$4,170 thousand.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D071 — Materials Scale-up: FY 1982 accomplishments included fabrication and testing of subscale capable of defeating advanced threat long-rod penetrator munitions, and initiation of evaluation of competing metal-matrix bottom chords having post-mobile tactical bridge structures. The overall objective of the project is to demonstrate scalability of new and advanced materials to ensure that superior properties can be retained in finished weapon system components. The work will help satisfy Army requirements to meet demands for faster, stronger, lighter, and at the same time, more economical weapon systems. The work will demonstrate reliability, maintainability, and cost effectiveness necessary for confident use. In FY 1983, work is in progress on scaling up and testing of high-performance for defeat of penetrator munitions. Full-scale, lightweight composite 105 millimeter-type gun tubes are being fabricated, instrumented, and tested. Scale-up of metal-matrix transmission gear box for CH-47D-type helicopter and metal-matrix components for tactical bridge structures is continuing. Work in this project in FY 1984 will be on five Army mission requirements. A full-scale prototype Bradley Fighting Vehicle-type hybrid steel/composite turret will be built and evaluated; Kevlar composite spell suppression liners will be built with curvatures for use in Infantry and Bradley Fighting-type vehicles; completion of fabrication of FP-Alumina metal matrix CH-47 type engine gear box and initiation of ground testing; full-scale silicon carbide-aluminum metal-matrix composite tactical assault bridge bottom chord components; and initial fabrication of metal-matrix composite sabots for M-774-type penetrator munitions.

2. (U) D077 — Materials Processing Advanced Development: This project is new as a part of restructuring overall the program element in FY 1984. Work will consist of materials processing advanced development for computerized wet winding of reduced-cost rotor blades for CH-470, AAH, and UH-60-type helicopters; fabrication and bonding of refractory metal gun tube liners for longer life 75-millimeter and 120-millimeter-type gun barrels; low-fabrication cost near net shape 774-type stainless steel penetrator munitions; forming and shaping of textured steel armor for Light Armored and Infantry Fighting-type Vehicles; fabrication of hardened optics for protection of Army weapon systems against threat laser weapon systems. Overall emphasis will be on evaluating optional processing procedures and determining the most effective and economical methods for reproducibly fabricating components. Work will be primarily directed toward those advanced materials for which an industrial base is nonexistent or greatly inadequate to provide the sizes, quantities, and performance quality required for major weapon systems.

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Program Element: #63102A

Title: Materials and Structures Advanced Development

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

3. (U) D085 — **Producibility/Reliability:** This project is new as a part of restructuring overall program element in 1984. Producibility emphasis will be on computerized automated fabrication of resin-matrix composites for CH-47D, UH-60, and AH-64-type helicopters rotor blades, to reduce costs of hand fabrication methods; lower cost and energy-saving, three-dimensional, hot-forming fabrication methods for turbine engine components for AH-64 and M1-type tanks; to provide unbroken, faultless hard-chrome layer, for 120-millimeter-type gun barrels; advanced formula rubbers to provide a minimum tenfold increase in tank track pad life and cut current costs per mile by approximately 50 percent for M1-type tanks. Major reliability emphasis will be on realtime weld quality monitoring of fabrication of M1-type armored combat vehicles to provide cost-saving concurrent welding and inspection; detection methods for extremely small critical flaws (.005-.015 inches) to increase the reliability of missile motor cases and prevent injuries to launch personnel; alternatives for penetrating radiation inspection methods for Army helicopter composite components to reduce radiation exposure of personnel and inspection equipment weight by reducing the heavy shielding requirements; and accurate, reliable methods to determine the remaining life in weapon system components subject to major levels of fatigue. Since critical components are discarded that may still have significant remaining life, a major potential exists for reducing logistics costs. In general, work in this project will resolve recognized producibility problems that affect the quality and reliability of Army weapon systems.

4. (U) D081 — **Specifications and Standards:** This project is new as a result of restructuring overall program element. Major emphasis will be on developing improved specifications and standards to produce new technical data packages (TDPs) for: electrosag-remelt (ESR) steels for ballistically tolerant aircraft components for Blackhawk-type helicopter and armor for Bradley-type fighting vehicles to accurately quantify materials properties required for unique military environments. Advanced resin-matrix composites for use in high-performance, lightweight aircraft structures, currently being developed in the All Composites Airframe Program (ACAP) and applicable to follow-on programs such as the Light Experimental Helicopter (LEH) and for product improvement in the current fleet; metal-matrix composites for aircraft transmission housings and tactical bridging components; accelerate the incorporation of these lightweight, high-strength materials to satisfy the highly mobile force requirements of Air/Land Battle 2000 doctrine; staballoy and tungsten long-rod penetrators to improve the quality of buys for M774 and M833-type kinetic energy munitions; and advanced rubbers for M1-type track pads to extend current track pad life. In general, work in this project is directed towards significantly improving the acquisition process by developing streamlined and tailored specifications and standards emphasizing reliability, availability, and durability, while reducing the time and cost of technology transfer from development to acquisition.

H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:** Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63104A

Title: Fuels and Lubricants Advanced Development

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1228	1866	3073	4590	Continuing	Not Applicable
D150	Fuels and Equipment	1228	1866	3073	4590	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Army's research, development, test, and evaluation program has been lacking in an adequate capability to conduct advanced development of component subsystem necessary for use of new fuels and lubricants and capability to execute field/user evaluation and testing prior to issuing new products. The purpose of this program is to conduct the necessary advanced development for new fuels, fluids, and subsystems, and to conduct field user evaluation to verify the acceptability of these fuels and lubricants for use in military vehicles and other items of materiel.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	1228	1866	3073	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	1304	1871	3878	Continuing	Not Applicable

Reduction of \$76 thousand in the FY 1982 funding level is a result of reprogramming to higher priority Army requirements.

The funding decrease of \$5 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE,A appropriation.

Reduction of \$805 thousand in the FY 1984 funding level is a result of the combination of realignment of programs and changes in scope and direction of Army mobility equipment programs.

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Program Element: #63104A

Title: Fuels and Lubricants Advanced Development

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable

E. (U) RELATED ACTIVITIES: In the fuels and lubricants technical area, active liaison and coordination is maintained with the other military departments, the Environmental Protection Agency, Federal Aviation Administration, and the Department of Energy. Unnecessary program duplication is avoided through the holding of regular joint meetings and reviews. Related exploratory development work is performed by the Army under Program Element #62733A (Mobility Equipment Technology). There is no unnecessary duplication of effort within the Army or Department of Defense in this program area.

F. (U) WORK PERFORMED BY: In-house work is performed by the US Army Mobility Equipment Research and Development Command, Ft. Belvoir, VA, and the US Army Fuels and Lubricants Research Laboratory, Southwest Research Institute, San Antonio, TX.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D150 — Fuels and Equipment: FY 1982 accomplishments included completion of: evaluation of gasohol fleet tests; acceptance test of long-life military greases; fabrication of first prototype fuel monitors; and testing of corrosion-inhibited turbine engine oil. Overall emphasis in the project is on field/user evaluation prior to issuing new products. In FY 1983, work is being conducted to accelerate testing of fuel monitors to provide protection against engine damage as more diverse and poorer quality fuel comes into the inventory; conduct engine and component tests on reference synfuels; perform user acceptance tests on fuel stabilizers; and continue validation of shale-derived fuel blends for major Army ground vehicles. In FY 1984 work will be conducted to: begin acceptance evaluations on multipurpose engine oils and long-life military greases; and fabricate prototype fuel monitors and begin testing and prepare reference synfuels for key military engines and components; expand field testing of shale-derived fuel blends; conduct advanced development and plan field tests of coal-derived fuels; conduct field tests of all-season engine oils and improve greases for military vehicles. Accelerate field tests of fuel monitors. Complete engine and component tests on reference synfuels. Continue development of field fuel-quality monitor of accelerated fuel qualification procedures. Perform user acceptance tests on fuel stabilizer, shale fuels, and nonflammable hydraulic oil. Continue field testing of shale-derived and coal-derived fuels. This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63201A

Title: Aircraft Power Plants and Propulsion

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	4491	7636	22725	36728	Continuing	Not Applicable
DB72	Propulsion Components	2345	1302	2042	3169	Continuing	Not Applicable
D447	Demonstration Engines	2146	6334	20683	33559	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The program objective is to evaluate and demonstrate the integration and performance potential of advanced propulsion components and drive train technology for application to helicopters in the 1990s that can support both Rapid Deployment Forces (RDF) and conventional heavier forces. This advanced engine and transmission technology will be developed for use in existing as well as advanced air mobility systems and will provide for significant improvements in fuel efficiency while substantially increasing reliability, maintainability, and availability for improved operational and mission effectiveness. Specific propulsion efforts are divided into two weight classes of aircraft to help reduce required components. The 800-horsepower Advanced Technology Demonstrator Engine (ATDE) is planned for light helicopters. The 5000-horsepower Modern Technology Demonstrator Engine (MTDE) will be applied to medium- to heavy-lift helicopters and to the Joint Services Advanced Vertical Lift Aircraft (JVX).

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	4491	7636	22725	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	2963	6660	33504	Continuing	Not Applicable

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Program Element: #63201A

Title: Aircraft Power Plants and Propulsion

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

The increase in FY 1982 funding level is a result of reprogramming to provide funds for the joint Army/Defense Advanced Research Projects Agency (DARPA) Large Transmission Technology program. The decrease in FY 1983 funds reflects reprogramming of funds for Army Data Distribution System. The reduction of FY 1984 funds is due to program realignment and reprogramming funds to higher priority Army requirements as well as revisions of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Mutual exchanges of information occur with the United States Air Force, the United States Navy, United States Marine Corps, and the National Aeronautics and Space Administration. Agencies are advised of program progress by semiannual meetings, an informal Tri-Service Coordination Group, by Joint Services Vertical Lift Aircraft (JVX) steering group meetings and visits to industry. Related Program Elements are #61102A (Air Mobility), #62209A (Aeronautical Technology), #64222 (Joint Services Vertical Lift Aircraft (JVX)), #62203F (Aerospace Propulsion), #63216F (Advanced Turbine Engine Gas Generator), #63202F (Advanced Propulsion Subsystems Integration), and #63210N (Advanced Aircraft Propulsion).

F. (U) WORK PERFORMED BY: The current and planned power plant and propulsion programs are the responsibility of the Applied Technology Laboratory of the US Army Research and Technology Laboratories, US Army Aviation Research and Development Command, Fort Eustis, VA. For the 800-horsepower Advanced Technology Demonstrator Engine (ATDE), contractors include Detroit Diesel Allison Division, General Motors Corporation, Indianapolis, IN, and AVCO Lycoming Division, Stratford, CT. The contractor for the large transmission technology effort is Boeing Vertol, Philadelphia, PA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: DB72 — Propulsion Components: The project objective is to validate advanced drive systems technology through design, fabrication, and tests of individual drive system components and subsequent integration and test in major drive system and/or experimental aircraft demonstrating significant weight reduction and improvements in reliability, maintainability, and flight safety for future aircraft systems. A major joint Army/Defense Advanced Research Projects Agency (DARPA) Large Transmission Technology program was initiated in FY 1982 and will continue through FY 1984. An Advanced Integrated Drive System program will be initiated in FY 1983 with a completion date in FY 1985.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

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Program Element: #63201A

Title: Aircraft Power Plants and Propulsion

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

1. (U) Project: D447 — Demonstration Engines

a. (U) Project Description: The objective of this project is to evaluate and demonstrate the technology integration and widespread potential of advanced technology propulsion components through integration of advanced components and full-scale developmental tests of propulsion systems. Primary emphasis is placed on Preplanned Product Improvement (P3I) of existing aircraft and on those areas that will benefit the near-term aircraft development programs. Improvements of 20-30 percent reduction in fuel consumption for gas turbine engines will be demonstrated with attendant reduction in maintenance man-hours and costs. Improved engine flight safety and tolerance to battle damage will also be validated. Some typical Department of Defense (DOD) performance improvements which will be achieved utilizing this technology include: for the Army, 100 percent improvement in productivity of medium lift helicopters under hot day altitude conditions; 37 percent range improvement in Navy antisubmarine warfare fixed-wing aircraft; 37 percent improvement in range of Air Force turboprop transports; and more than \$500 million in fuel savings for the Joint Services Vertical Lift Aircraft (JVX) fleet with attendant improvements in capability.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Final demonstration testing of the two 800-shaft-horsepower Advanced Technology Demonstrator Engines (ATDE) was completed in FY 1982. Two contracts were also awarded in FY 1982 for follow-on efforts to the ATDE for performance testing using alternate/synthetic fuels as well as a further evaluation of components not validated in the basic program. A Memorandum of Understanding (MOU) for a jointly developed 5000-horsepower, modern-technology (fuel-efficient) demonstrator engine (MTDE) program was agreed to and signed by both the Army and Navy. One of the greatest improvements in aircraft performance, payload, endurance, capability, availability, and empty weight can be achieved by fuel-efficient/lightweight engines. The objective for the MTDE is to full-scale demonstrate a 20-35-percent reduction in mission fuel or a 40-50-percent increase in aircraft range for the same mission fuel. The resulting reduction in engine size and weight also means a significant reduction in critical materials. The MTDE initial program coordination was effected with both the Navy and Air Force, resulting in definition of requirements which meet each Service's requirements and desires for this class of engine. This early coordination is considered significant and will preclude subsequent requirements to tailor the engine for each Service's specific needs.

(2) (U) FY 1983 Program: In December 1983, the Under Secretary of Defense (Research-Engineering) issued a Decision Memorandum directing that the Army will fund and complete the Modern Technology Demonstrator Engine (MTDE) Advanced Development Program and will continue as the Executive Service for the Full Scale Engineering Development of the Modern Technology Engine (MTE). Further, it directed that the cost sharing for the Full Scale Engineering Development of the MTE be equally shared (one third per service) by all three services; Navy, Army and Air Force. In second quarter FY 1983, the Service cooperative Modern Technology Demonstrator Engine (MTDE) program will be initiated. The MTDE will be the world's most advanced technology turboshaft/turboprop engine with broad potential applications to helicopter, fixed-wing aircraft, and advanced

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Program Element: #63201A

Title: Aircraft Power Plants and Propulsion

DOD Mission Area: #663 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

concepts such as the tilt rotor aircraft. Two contracts will be awarded. Detailed engine design and component test and evaluation will continue from the initial proposal activity. These component tests will validate design analyses. A full-scale engine mockup will be fabricated for subsequent use in conducting maintainability and vulnerability analyses, as well as for determining external location of accessories and other ancillary components/subsystems. Work will also continue on the 800-shaft-horsepower Advanced Technology Demonstrator Engine (ATDE) follow-on program with final drawings and reports submitted by contractors. A determination will be made as to the capability of the engine to perform using alternate/synthetic fuel with continued validation testing of critical components. The integration of advanced high-efficiency components in an engine one-half the power and size of the current T700 provides a strong technology base for small engines with significantly reduced fuel consumption, integrated digital controls, and particle separators. The next generation of light Army helicopters will require this technology for improved speed, range, and payload.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: The Service cooperative Modern Technology Demonstrator Engine (MTDE) program will continue. The initial series of component test and evaluation will be completed and the hardware integrated into a gas generator for subsequent evaluation. The gas generator tests will provide the initial assessment of the integrated performance of the components and provide early identification of the mechanical design characteristics. Additional follow-on component testing will continue, incorporating modifications dictated by the initial component and gas generator tests. Assembly of the first full engine will be initiated, with testing to follow in FY 1985. Limited Advanced Technology Demonstrator Engine (ATDE) testing will continue to investigate specific Light Helicopter Series (LHX) interface requirements (emergency power capability, short-time transient capability, etc.) and investigative test of ATDE engine with the adaptive fuel controls installed.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
Original Army/Navy Memorandum of Understanding (MOU) Signed	4Q FY 1981	Not Applicable
Determination & Findings Approval	2Q FY 1982	Not Applicable
Request for Quotation Issued	4Q FY 1982	Not Applicable
Proposals Received	1Q FY 1983	Not Applicable
Start Modern Technology Demonstrator Engine (MTDE) (Contract Award)	2Q FY 1983	1Q FY 1983

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Program Element: #63201A

Title: Aircraft Power Plants and Propulsion

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
Initiate Component Testing	2Q FY 1983	Not Applicable
Complete Final Design	4Q FY 1983	Not Applicable
Mockup Completed	4Q FY 1983	Not Applicable
Complete Series I Component Test	3Q FY 1984	Not Applicable
First Gas Generator Test	4Q FY 1984	Not Applicable
First Engine to Test	2Q FY 1985	Not Applicable
Accumulate 200 Hours of Engine Testing	4Q FY 1985	Not Applicable
Delivery of Engine to Naval Propulsion Test Center (NAPTC)	1Q FY 1986	Not Applicable
Initiate Altitude Testing	2Q FY 1986	Not Applicable
Official 30-Hour Durability Test Completed	4Q FY 1986	Not Applicable
Demonstration Completed	3Q FY 1986	2Q FY 1986

The changes in the milestone dates are not considered significant and are due primarily to the requirement to conduct an extensive, in-depth Army/Navy/Air Force/NASA analysis of the proposals received.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63208A

Title: Aircraft Weapons

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology
Developments

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	4489	200	6894	8035	Continuing	Not Applicable
D043	Aircraft Weapons Fire Control	4489	- 0 -	2444	5894	Continuing	Not Applicable
D044	Aircraft Gun-Type Weapons	- 0 -	200	- 0 -	- 0 -	Continuing	Not Applicable
D318	Air Self-Defense Systems	- 0 -	- 0 -	4450	2141	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is essential to support the advanced development and test of new aircraft weapon subsystems and upgrade of existing equipment which will improve and sustain the operational effectiveness and mission capability of Army aviation in the conduct of the land battle. Program objectives are to develop and demonstrate concepts in target acquisition, identification, fire control and air self-defense weapons systems. This will include weapons systems that satisfy the need for improved accuracy and terminal effects, reduced aircraft exposure during target acquisition and engagement, adverse weather capability, and overall improved system reliability. The program objectives will be accomplished through the design, fabrication, and test of advanced target acquisition, fire control, and air self-defense weapons systems as well as the adaptation of existing equipment for near-term air self-defense on US Army aircraft.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	4489	200	6894	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	497	5581	16253	Continuing	Not Applicable

Increase of \$3992 thousand in the FY 1982 funding level reflects Army reprogramming of resources to exploit promising emerging technology. The reprogramming occurred subsequent to Congressional action cutting FY 1982 program funds without prejudice. The funding decrease of \$5381 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act. The funding decrease of \$9359 thousand in FY 1984 is a

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Program Element: #63206A

Title: Aircraft Weapons

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology
Developments

result of program restructure. This restructure included termination of the Helicopter Adverse Weather Fire Control/Acquisition Radar (HAWFCAR), deletion of funding request for aircraft gun-type weapons project and increased emphasis on the air self-defense program.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Project personnel maintain close liaison with other Services and with industry to avoid duplication of effort. The Army participates in the Department of Defense Tri-Service Joint Technical Coordination Group for munitions development. Army personnel working within this program participate in the North Atlantic Treaty Organization Air Armament working party and the Air Standardization Coordinating Committee, working party 20. These groups and working parties provide a medium for exchange of technical information and determination for joint use and standardization of airborne weaponization items. An Army representative serves on the Air Munitions Requirements and Development committee (AMRAD), an organization within the Office of the Secretary of Defense. One function of this committee is the establishment of joint Service requirements and development of air munitions. Related exploratory development is conducted under Program Element #62202A (Aircraft Weapons Technology) and engineering development under Program Element #64202A (Aircraft Weapons).

F. (U) WORK PERFORMED BY: In-House: US Army Aviation Research and Development Command (AVRADCOM) St. Louis, MO; US Army Armament Research and Development Command, Dover, NJ; US Army Missile Command, Huntsville, AL; US Army Electronics Research and Development Command (ERADCOM) Fort Monmouth, NJ.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D043 — Aircraft Weapons Fire Control: This program is needed for the advanced development and test of aircraft target acquisition and fire control subsystems to improve the mission effectiveness of US Army Aircraft under conditions of day/night adverse weather and limited visibility. Current target acquisition systems rely on the pilot or gunner's ability to recognize targets. This by nature is skill dependent and time consuming, especially when acquiring targets at extended ranges using Forward Looking Infrared (FLIR) imagery. New concepts in target acquisition and fire control will be developed to improve system accuracy and terminal effects, reduce target acquisition time, and improve overall system reliability. During FY 1982, a Memorandum of Understanding was signed for a joint program with the US Army Electronic Research and Development Command's Night Vision and Electro-Optics Laboratory. The objective of this program is to develop and demonstrate, in an operational scenario, an advanced automatic target recognizer. This system processes Television (TV) and FLIR sensor data to detect and classify hostile targets, and has the potential of significantly reducing target acquisition time, thereby reducing aircraft exposure time and crew workload. Also during FY 1982, preliminary design efforts were completed on the Helicopter Adverse Weather Fire Control and Acquisition Radar (HAWFCAR). No further work is planned in this program as it could not fulfill the total user requirement. FY 1983 plans are to continue the joint AVRADCOM/ERADCOM automatic target recognizer

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Program Element: #63206A

Title: Aircraft Weapons

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology
Developments

program and initiate aircraft integration efforts, which will result in flight test of the system. FY 1984 plans are to complete integration of the automatic target recognizer into a test aircraft and conduct evaluation flight testing of the system.

2. (U) D318 — Air Self-Defense Systems (NEW START): This program is needed to provide US Army helicopters with a self-defense capability. Current combat helicopters have not been equipped with effective air-to-air weapon systems. Current heliborne weapons are designed to function in an air-to-ground antitank and antipersonnel role and are not designed for the quick-reaction, highly dynamic environment of air-to-air engagements. The objective of this project is to develop an effective air self-defense capability which will provide the combat helicopter the ability to continue with the accomplishment of its primary mission when faced with attack from enemy aircraft. Initial emphasis will be given to modification and utilization of existing armament and fire control components with subsequent development addressing new technology and equipment oriented toward defeating a more sophisticated threat. FY 1984 efforts involve investigation of an existing missile system for adaptation to provide a near-term air self-defense capability which could be transferred quickly to full-scale development.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63207A

Title: Aircraft Avionics Equipment

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	4314	2558	4945	6953	Continuing	Not Applicable
DB97	Avionics Equipment	4314	2558	4945	6953	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This element supports generic advanced development of avionics systems and subsystems needed for Army aircraft to operate at Nap-of-the-Earth (NOE) altitudes, in a high-threat environment in adverse weather, during day/night as part of the combined arms team. Near-term efforts will concentrate on the Future Airborne Communications Equipment Technology (FACET) program and technology demonstration of integrated avionics systems via the Systems Testbed for Avionics Research (STAR), which is a specially instrumented UH-60 Blackhawk. These efforts will lead to engineering development of cockpit instruments, communications equipment, environment sensors, and navigation systems necessary for NOE combat. Emphasis is on hardware which will provide a capability for day/night, adverse weather aviation operations in a mid- to high-intensity war environment. FACET consists of three subsystems: Integrated Communications, Navigation, Identification, Avionics (ICNIA); Digital Multiplexed Audio System (DMAS); and Voice Interactive Avionics (VIA). These subsystems start advanced development in FY 1983, FY 1984, and FY 1985, respectively. ICNIA is an Air Force development program that the Army is adopting for helicopter use. Another related effort initiated in this element is the Integrated Lighting System for Army Aircraft (ILSAA), which begins in FY 1983. This will be a one-year effort to address the compatibility problem between night vision goggles and color displays such as digital maps. The outyear program will develop cockpit lighting standards for future aircraft which will achieve compatibility between all instrument lighting panels and the pilot's night vision goggles. This compatibility is a fundamental consideration in developing the capability to fly at night or in adverse weather at NOE altitudes.

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Program Element: #63207A

Title: Aircraft Avionics Equipment

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	4314	2558	4945	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	2312	4494	6868	Continuing	Not Applicable

1. (U) FY 1982 — \$2002 thousand increase represents partial restoration of prior year funding cuts in the STAR aircraft program. These funds were essential to maintaining the scope and schedule of planned efforts in support of Light Helicopter (LHX) aircraft.

2. (U) FY 1983 — The decrease of \$1936 thousand was due to: a reprogramming to a Compartmented Program in another program element (\$1100 thousand); reprogramming to 105mm Gun Enhancement (\$824 thousand); and \$12 thousand was a share of general Congressional reductions to the RDTEA appropriation.

3. (U) FY 1984 — \$1923 thousand decrement to fund other high-priority projects necessitated cancellation of the Air Traffic Control Testbed (\$424 thousand) and all effort in controls and displays (\$1050 thousand), which included Standard Programmable Control Display Modules (SPCDM), Multifunction Programmable Keyboard (MFPK), and ILSAA. The remaining reduction of \$449 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Coordination is maintained within DOD and with other countries and agencies through meetings and committees (i.e., Acoustical Society of American Standards, Committee on Acoustics and Noise; Air Standardization Coordination Committee, Working Party 10; Advisory Group for Aerospace Research and Development; and Military Agency for Standardization, Aircraft Instruments and Aircrew Stations Working Group.) A Memorandum of Agreement (MOA) exists with the Air Force for ICNIA. The MOA is between the US Army Avionics Research and Development Activity (AVRADA) and Air Force Wright Aeronautical Laboratories, with AVRADA responsible for: participation as an active member in the ICNIA program, providing the statement of work, specifications, and necessary funding to modify the system to include Army-unique requirements, and contract monitoring. This program element is related to Program Elements #62202A (Aircraft Avionics Technology) and #64201A (Aircraft Avionics). There is no unnecessary duplication of effort within the Army or Department of Defense.

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Program Element: #63207A

Title: Aircraft Avionics Equipment

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

F. (U) WORK PERFORMED BY: Sperry, Phoenix, AZ; Raycomm, Freehold, NJ; Mtre, Boston, MA; Rockwell International, Cedar Rapids, IA; US Army Avionics Research and Development Activity, Fort Monmouth, NJ; US Air Force, Wright-Patterson AFB, Ohio.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: DB97 — Avionics Equipment: The two principal thrusts of this project are: advanced development of Future Airborne Communications Equipment Technology (FACET) and technology demonstration of integrated avionics systems in the UH-60 Systems Testbed for Avionics Research (STAR). FACET will provide reduced acquisition and installation costs, increased system flexibility, improved TEMPEST (security) characteristics and graceful degradation in the event of equipment failure. Systems currently scheduled for installation and test in the STAR aircraft include the Army Digital Avionics System (ADAS), Night Navigation and Pilotage System (NNAPS), Multifunction CO₂ NOE Sensor, and the Digital Multiplexed Audio System (DMAS). FACET will solve several deficiencies in fielded airborne radios—increased communications security, sustained communications in a dirty battlefield, and reduction of pilot workload to meet the exacting demands of Air/Land Battle 2000. It will provide 41% reduction in weight, 49% reduction in size, and 65% reduction in life cycle cost. The STAR will act as the technology demonstrator for future aircraft such as LHX, and the small, light-helicopter one-man cockpit. FY 1982 — Completed flight testing of Phase 2 Night Navigation and Pilotage System (NNAPS) in the STAR aircraft. Data were gathered to develop a flight-validated terrain-aided navigation algorithm for NNAPS. The resultant algorithm, which will be developed, is critical to the terrain-correlation capability of NNAPS to update Doppler Navigation drift errors. Phase 2 NNAPS will remain an integral part of STAR until Phase 3 NNAPS becomes available. FY 1983 — Initiate Army efforts in Air Force-managed ICNIA program. Flight test POD I of the Multifunction CO₂ NOE Sensor in STAR aircraft. Install the following systems in STAR aircraft: Army Digital Avionics System (ADAS); palletized DMAS and palletized VISTA. These are 6.2 breadboard systems. FY 1984 — Monitor ICNIA contract awarded in FY 1983. Initiate contract for flyable models of DMAS. Prepare procurement data package for FY 1985 award of VIA contract (new start in FY 1985). Perform STAR flight tests of ADAS, DMAS, and VIA (breadboard models). Install POD II Multifunction CO₂ NOE Sensor in STAR. Install and flight test Phase 3 NNAPS in STAR aircraft.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63208A

Title: Air Mobility Support

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2787	3641	7162	9122	Continuing	Not Applicable
DB32	Ground Support Equipment	- 0 -	- 0 -	301	1079	Continuing	Not Applicable
DB33	Cargo-Handling Equipment	231	569	294	- 0 -	Continuing	Not Applicable
DB45	Aviation Life Support Equipment	2556	3072	6567	8043	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The US Army must not only develop aviation systems for increased firepower and mobility, but also the support equipment necessary to gain maximum effectiveness from these systems and their crews. This program develops new Aviation Life Support Equipment (ALSE) to improve efficiency and survivability of aircrews in a Nuclear, Biological, Chemical (NBC) environment. It includes a new NBC clothing ensemble (ALSSIB) and a new NBC aviator mask. It further provides for development of a new Inflatable Body and Head Restraint System (IBAHRS) for the AH-1/AH64 and development of a new Aviator Integrated Helmet System, and new laser-protective devices for aviators. The program element also provides for the Advanced Development of: (1) new cargo-handling equipment to increase the speed and reduce the manpower required for the loading, movement, and off-loading of cargo by helicopter; (2) new equipment for aerial recovery; (3) new aircraft subsystems for helicopter external load operations in all-weather, round-the-clock combat scenarios; and (4) new means of helicopter external load in-flight stabilization to permit terrain-following maneuverability. It additionally provides for the Advanced Development of aviation ground support equipment to gain maximum utilization of current and future aircraft by (1) enhancing the maintenance and servicing of aircraft; (2) replacing obsolete, unsupportable ground support equipment by developing new, standardized, multi-output ground support equipment items useful on all Army aircraft models; and (3) developing rapid battle damage repair procedures, tools and concepts to speed the return of aircraft to combat-ready status.

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Program Element: #63209A

Title: Air Mobility Support

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2787	3641	7162	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	1809	3784	7484	Continuing	Not Applicable

The increase of \$978 thousand in FY 1982 is the combined result of reducing scope in the Manufacturing Technology and Cargo-Handling Equipment Areas and increasing the Aviation Life Support Equipment Project. The decrease of \$143 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act and pro rata application of general Congressional reductions to the RDTEA appropriation. The reduction of \$202 thousand in FY 1984 is the combined result of reducing scope in the Manufacturing Technology, Cargo-Handling Equipment and Ground Support Equipment Areas and increasing the Aviation Life Support Equipment Project.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Program Element #62209A (Aeronautical Technology) and Program Element #64204A (Air Mobility Support Equipment). Aviation Life Support Equipment (LSE) is coordinated through the Tri-Service LSE Working Groups and the LSE Management Steering Council. Cargo-handling equipment developments are closely coordinated with the development of airdrop equipment and techniques through the Joint Technical Airdrop Group (formerly Joint Technical Coordinating Group for Airdrop) and the annual OSD Apportionment Review of Aeronautical Technology. Project personnel maintain close liaison with other military services and industry and participate in joint working groups to avoid unnecessary duplication.

F. (U) WORK PERFORMED BY: Human Engineering Laboratories, Aberdeen Proving Ground (APG), MD; Chemical Systems Laboratories, APG, MD; Naval Air Development Center, Warminster, PA; Thiokol Corp, Brigham City, UT; TECHNAR, Inc., Arcadia, CA; Natick Research Laboratories, Natick, MA; US Air Force at Wright-Patterson AFB, OH; Letterman Army Institute, San Francisco, CA. (Helmet contractor to be named later.) Sikorsky Aircraft Division, United Technologies Corp., Stratford, CT; Bell Helicopter Textron, Ft Worth, TX. The in-house developing organizations for Ground Support Equipment is the US Army Aviation Research and Development Command, St Louis, MO.

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Program Element: #63208A

Title: Air Mobility Support

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) DB32 — Ground Support Equipment (NEW START): This project provides Advanced Development (AD) actions for Helicopter Battle Damage Repair (HBDR) Concepts and Damaged Aircraft Recovery Kits. This project was unfunded in FY 1982 and prior years. In the Exploratory Development effort, the HBDR aircraft electrical repair kit and fluid line repair components were tested and readied for Advanced Development. The FY 1983 funds were deleted by Congressional action in the FY 1983 Authorization Act. The FY 1984 program will initiate AD of the electrical and fluid line HBDR kit. The FY 1985 program will result in completion of HBDR kits, DT/OT I testing, and initiation of additional aircraft subsystem repair kit design and fabrication. Also, the design and fabrication of the advanced material aircraft recovery kit components will be initiated.

2. (U) DB33 — Cargo-Handling Equipment: This project provides AD action for the Advanced Materials External Cargo Sling Systems (AMCSS), the Low-Visibility Load Acquisition System (LOVLAS), and the flight testing of the tandem two-hook beam (TTHB) on the UH-60A helicopter. FY 1982 accomplishments include contracting for flight test support for the in-house testing of the TTHB and award of contract for the optimization and design of the LOVLAS system and components. The FY 1983 program will provide for continuation of the TTHB and LOVLAS efforts and initiation of the design and fabrication of the AMCSS Advanced Development hardware. The FY 1984 program will provide for the fabrication, completion, and test of the AMCSS and LOVLAS hardware.

3. (U) DB45 — Aviation Life Support Equipment: This project provides AD actions for the Inflatable Body and Head Restraint Systems (IBAHRS), Aircrew Integrated Helmet System (IHS), Aircrew Life Support System Integrated Battlefield (ALSSIB), CB protective mask, Hot Air Decontamination System and Laser Protective Equipment. FY 1982 accomplishments include initiation of Advanced Development for the IHS, joint development of nuclear and laser protective devices with the US Air Force and a new CB aviator protective mask. The FY 1983 program includes initiation of Advanced Development for the ALSSIB and aircrew laser protective devices, completion of the IBAHRS DT/OT I and continuation of Nuclear, Biological, and Chemical (NBC) effort for the CB Mask. The IHS will begin DT/OT I. IBAHRS is planned to move into Engineering Development in FY 1984. The FY 1984 program continues for these projects and initiates DT/OT I of the IHS and the CB Protective Mask. It initiates Advanced Development of the Airborne Remote Chemical Detection System. The FY 1985 program continues Advanced Development of these projects.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63211A

Title: Rotary Wing Controls, Rotors, and Structures

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	28438	32615	34649	41412	Continuing	Not Applicable
DB41	Advanced Structures	18992	21336	18861	16402	Continuing	Not Applicable
D313	Research Aircraft Systems	2285	1243	2124	4094	Continuing	Not Applicable
D314	Advanced Rotor Systems	495	692	4914	10783	Continuing	Not Applicable
D315	Advanced Flight Controls	6666	9344	8750	8133	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Army needs to field future aviation systems that are less expensive, smaller, faster, and simultaneously more sustained, reliable, maintainable, safer, and survivable. In Central Europe, the Middle East, or any other scenario, the modern helicopter will face an awesome array of air defense threat systems to include optically and radar-guided 23mm, 30mm, and 57mm weapons; SA-6, 7, and 9, infrared and radar-guided missiles; and potential nuclear/biological/chemical and laser threats directed and delivered both from the ground and air vehicles. As a result, the helicopter must possess improved mobility, agility firepower, and inherent features providing durability and sustainability for extended periods of combat at an affordable cost. Army helicopters must be durable, damage resistant, easy to repair and maintain, and possess the highest level of availability possible. The application of composite materials to primary helicopter structures and advanced design techniques, fiber-optic technology to flight controls, and advanced rotor technology to existing and proposed rotor systems is the key to providing reliable, survivable Army aviation assets essential to the future integrated battlefield. These Advanced Technology Development programs represent investments in technology development in order to maximize Army aviation's future availability and capability to perform its combat mission. This program element provides for the advanced development and demonstration of full-scale aircraft components and subsystems. As such, the work supported by this program element directly addresses these critical needs essential to future operational effectiveness through full-scale flight testing and demonstration of advanced state-of-the-art components and subsystems. Current emphasis is placed on advanced composite rotary-wing structures for lower weight, lower costs, longer life, and improved survivability; on advanced rotors for improved performance and ballistically tolerant materials at lower cost and reduced maintenance requirements; and on advanced flight controls for reduced weight and cost, improved survivability, and reduced pilot workload and initial training requirements. Support costs for maintaining the experimental research and test aircraft used in the above programs are carried under a separate project line (D313) as shown above. The efforts to be accomplished under this program element will be a significant part of the technology base for the next-generation helicopters of the early-to-mid-1990s. Selected near-term advances will be applied to

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Program Element: #63211A

Title: Rotary Wing Controls, Rotors, and Structures

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

aircraft such as the UH-60 Black Hawk and AH-64 Apache as block modifications. This program funds technology thrusts that are absolutely essential if Army aviation is to effectively contribute to the air-land battle of the 1990s to 2000 as it does to the current Army combined arms team.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	28438	32615	34849	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	28438	33809	45459	Continuing	Not Applicable

The FY 1983 decrease is the result of reprogramming action to higher priority Army compartmented requirements. The FY 1984 decrease reflects reprogramming action within the Army to higher priority Army requirements as well as revisions of the anticipated inflation in the proposed Army RDTE Budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The technologies being developed and demonstrated in this program element are closely coordinated and related to work being conducted by the Navy, Air Force, National Aeronautics and Space Administration (NASA), and other Army agencies such as the Army Materials and Mechanics Research Center (AMMRC). Duplication of effort is avoided through coordination with these agencies on a continuing basis and through joint program reviews, exchange of information and reports, the Technical Cooperation Program, NASA Research and Technology Committees, North Atlantic Treaty Organization (NATO) Standardization Agreements, and the NATO Advisory Group on Aerospace Research and Development (AGARD), as well as drawing upon the technical expertise of these agencies in the definition and pursuit of these programs. Efforts under this program element are related to activities under Program Element #62209A (Aeronautical Technology) and Program Element #63220A (Advanced Rotorcraft Technology Integration-ARTI) in investigating mission systems integration and maneuverability. The Tilt Rotor Research Aircraft program (XV-15) is jointly funded by the Army, Navy and the National Aeronautics and Space Administration (NASA); and the rotor research program utilizing the Rotor Systems Research Aircraft (RSRA), and the Integrated Technology Rotor/Flight Research Rotor (ITR/FRR) through a Memorandum of Understanding had their origin within efforts performed in Program Element #62209A (Aeronautical Technology). Based on the extensive coordination stated above, there is no unnecessary duplication of effort within the Army or the Department of Defense.

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Program Element: #63211A

Title: Rotary Wing Controls, Rotors, and Structures

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

F. (U) **WORK PERFORMED BY:** The top five contractors performing this work are: Bell Helicopter Textron, Fort Worth, TX; Boeing Vertol Company, Philadelphia, PA; Hughes Helicopters, Culver City, CA; Kaman Aerospace Corporation, Bloomfield, CT; and Sikorsky Aircraft, Stratford, CT, with an anticipated contract dollar value for FY 1984 in excess of \$25 million. This work is performed by the Research and Technology Laboratories of the US Army Aviation Research and Development Command located at Moffett Field, CA; Fort Eustis, VA; and Hampton, VA. Work in related activities is also performed by the National Aeronautics and Space Administration (NASA), Ames Research Center, Moffett Field, CA, and Langley Research Center, Hampton, VA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) **D313 — Research Aircraft Systems:** The purpose of this project is to provide Army support for flight research aircraft involved in research programs conducted under the Army/National Aeronautics and Space Administration (NASA) Joint Agreement. The extent of Army operational support of flight research aircraft is determined by Army research program requirements and agreements signed by the Assistant Secretary of the Army for Research, Development and Acquisition. Combined Army/NASA FY 1982 and FY 1983 funds provided sufficient capability to continue the development of the Rotor Systems Research Aircraft (RSRA), conduct development and operational suitability testing on the XV-15 Tilt Rotor Research Aircraft (TRRA), and supported selected Aeromechanics basic research and exploratory development programs. The FY 1984 program will involve continued operational support of flight research aircraft, and the RSRA aircraft will be used to initiate the S-61 rotor system baseline research experiments. The operational support of research aircraft including the RSRA, AH-1S, YO-3A, CH-47, and SH-3 is essential for the continuation of joint research and development programs conducted under the Army/NASA Agreement.

2. (U) **D314 — Advanced Rotor Systems:** The purpose of this project is to design, fabricate, and test advanced rotor systems to demonstrate the maximum potential performance and cost reduction techniques available from the integration of aerodynamic and structural improvements ready for use from Government research and exploratory development programs and Industry Independent Research and Development (IR&D) programs. The project is needed to overcome such Aviation Mission Area Analysis (AMAA) deficiencies as inadequate helicopter payload capability in 4000-foot, 95-degree conditions; inadequate helicopter range capability for battlefield resupply; inadequate maneuver agility/power in scout helicopter missions and inadequate rotor system reliability and maintainability. A few of the benefits to be demonstrated as a result of this project effort include a 25-percent improvement in Hover Out of Ground Effect (HOG E) altitude (approximately 1000 feet); a 6-percent increase in range through improved aerodynamics; an 18-percent increase in productivity (Ton Miles Payload) over the basic UH-60 Black Hawk mission; and a potential 60-percent reduction in integral parts over existing articulated rotors. Another significant outgrowth will be the elimination of bearings and hinges in the blade retention system to improve reliability, maintainability, and availability. The FY 1982 accomplishments consisted of the Concept Definition Phase of the Integrated Technology Rotor/Flight Research Rotor (ITR/FRR) Program, where five contractors examined various rotor hub concepts, geometric constraints, component sizing control system layouts and approximate stress levels to identify structural configurations on which to base a preliminary

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Program Element: #63211A

Title: Rotary Wing Controls, Rotors, and Structures

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

design. These efforts were completed in third quarter FY 1982. A Request for Proposal (RFP) was issued in third quarter FY 1982 for the Preliminary Design Phase. The actual Preliminary Design Phase of the ITR/FRR will be initiated in the third quarter of FY 1983. This phase will include the preliminary design of the ITR/FRR rotor system characterized for various aircraft interfaces. In the first quarter FY 1984, a wind tunnel test of the ITR/FRR will be conducted to verify aeromechanical stability. Preliminary Design of the ITR/FRR will be completed in the third quarter FY 1984. At this time, one or possibly two contractors will be competitively selected to conduct detail design, fabrication, and flight test of the rotor systems.

3. (U) D315 — Advanced Flight Controls: The objective of this program is to advance flight control technology for Army aircraft through development, verification, and validation of improved flight control concepts. This program is necessary to provide improved capability, survivability, reliability, maintainability, and a better crew-aircraft (man-machine) interface for rotorcraft systems. The program includes the integration of flight control system logic mechanization, displays, and sensors into the aircraft system. The basic approach uses a digital avionics and fiber optics data connector. The principal goal of the program is to permit pilots to perform demanding nap-of-the-earth, adverse weather, and night operational missions without mission degradation due to excessive pilot workloads and allow the pilots to concentrate on tactical mission needs. Emphasis will be on systems that can be retrofitted to existing aircraft as product improvements and on supporting near-term development programs. Critical test missions include tactical flight profiles for nap-of-the-earth/low-level terrain flying during adverse weather and hostile battlefield conditions for both day and night operations. The purpose of this program's major project, the Advanced Digital Optical Control System (ADOCS), is to advance flight control technology to provide a battlefield-compatible flight control system for engineering development. The Advanced Digital Optical Control System (ADOCS) program is necessary to provide for survivability of the control system in the natural and manmade electromagnetic (EMI/EMP) environment of the future battlefield. The program will also provide improved capability, reliability, maintainability, and reduced ballistic vulnerability. Mission-tailored handling qualities and control laws combined with improved crew-aircraft (man-machine) interfaces will significantly improve rotorcraft mission performance. The FY 1982 accomplishments include the following: The technical work of the six electrically passive digital optical transducer programs and two optical servovalve programs with final report were completed. The Phase I simulations for the Advanced Cockpit Controls/Automatic Flight Control System contract were completed, and an industry briefing provided early technology transfusion. An optical-fluidic servovalve contract was awarded to eliminate the need for electrical power at the control actuator. The contract to assemble this new technology into a redundant optical control system for flight demonstration was awarded in November 1981 to the Boeing Vertol Company. The ADOCS Flight Demonstrator Program Preliminary Design was essentially completed in FY 1982 and the Preliminary Design Review was completed in October 1982. In FY 1983 the Flight Demonstrator detail design will be completed, hardware fabrication initiated, and bench testing accomplished. Phase II of the Advanced Cockpit Controls/Automatic Flight Control System simulation will be completed in the second quarter FY 1983 for input to the Flight Demonstrator program and another technology transfusion briefing to industry accomplished. In FY 1984 the Flight Demonstrator hardware fabrication will be completed; helicopter modification and system installation will be completed; and ground testing will be initiated.

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Program Element: #63211A

Title: Rotary Wing Controls, Rotors, and Structures

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: DB41 — Advanced Structures

a. (U) **Project Description:** The objective of this project is to demonstrate and establish advanced structures technology for Army helicopters. The Advanced Structures Technology resulting from this program will be applicable to current aircraft (UH-60 Black Hawk and AH-64 Apache) as preplanned product improvements (P3/) as well as future Army aircraft systems such as the Joint Vertical Lift Aircraft (JVX) and the Light Helicopter Series (LHX) and, ultimately, will benefit other DOD services, agencies, and the US helicopter and aircraft industry as well. This program is designed to demonstrate that composite materials technology can be applied to primary rotorcraft structures to gain significant system improvements including: increased ballistic damage tolerance, potentially reduced radar cross-section (RCS), improved crashworthiness, reduced maintenance, improved reliability, easier repair of battle damage, improved survivability while operating in a combat environment, and less energy consumption. It will also provide a significant (20-30 percent) weight and cost reduction. Composite materials require less energy for fabrication than metals with a significant potential for further reduction through lower temperature, quick curing resin systems, and single-stage curing—resulting in reduced demand for expensive metals in critically short supply and reduced life cycle costs. The near-term goals for this program are a demonstration of a 20-percent reduction in airframe cost and a 24-percent reduction in airframe weight when compared with a baseline metal airframe. A very high potential exists for extending this savings to a 25-30-percent airframe cost reduction and a 30-35 percent airframe reduction for future helicopter systems.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) **FY 1982 Accomplishments:** The competitive Phase I, Detailed Design and Design Supporting Test of the Advanced Composite Airframe Program (ACAP) awarded to Sikorsky Aircraft and Bell Helicopter Textron was successfully completed on cost and schedule achieving the establishing technological goals by both contractors. Through extensive use of computer-aided design and manufacturing (CAD/CAM), the detailed design was completed in record time with less than half the man-hours normally required. The manufacturing plan for proceeding into Phase II fabrication has been completed. Structural, ballistic, and crash test of the critical components such as roof structures, belly structure, landing gear, structural panels, major joints and attachments were successfully completed. Lightning tests and laser assessments were also conducted producing the desired results. The Critical Design Reviews (CDR) and In-Process Reviews (IPRI) were successfully completed on schedule leading to the exercise of the Phase II option, Design Update, Fabrication, Structural Tests and Ground and Flight Test, with both contractors in September 1982. Both Sikorsky Aircraft and Bell Helicopter Textron will continue the Phase II effort.

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Program Element: #63211A

Title: Rotary Wing Controls, Rotors, and Structures

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

(2) (U) FY 1983 Program: During FY 1983, the detailed design will be updated as required based on the results of the design support tests conducted in Phase I. Required tooling for fabricating the Advanced Composite Airframe Program (ACAP) will be built and the tool proofing and static-shake test airframe will be fabricated. Structural tests, including static and shake tests, will also be initiated.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: The critical static and shake test of the composite airframe will be completed in FY 1984. Fabrication of the flight test airframe will also be completed. Ballistic, electromagnetic, and drop test of a complete ACAP airframe will be prepared for flight and fifteen hours of ground test of the flight vehicle will be conducted. A 50-hour flight test program will be initiated in fourth quarter of FY 1984.

(4) (U) Program to Completion: Both contractors will complete the required 50 engineering-flight-hour test program. Analysis of all data will be conducted to verify achievement of the established goals for weight, cost, crashworthiness, ballistic damage tolerance, and reduced radar cross-section. The Advanced Composite Airframe (ACAP) Program will be completed in the second quarter of FY 1985. Based on the experience gained in the ACAP, the advanced composite structures technology will be utilized to initiate an Advanced Composite Rotor Hub program in FY 1985. This planned three-year program will be to develop and demonstrate composite rotor hub technology for implementation into the Army's inventory and new aircraft systems. The goals for this program are also expected to be 25-percent weight savings and 25-percent acquisition cost savings. This is a continuing program.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
Preliminary Design Completion	3Q FY 1980	3Q FY 1980
Phase I Award	2Q FY 1981	2Q FY 1981
Phase I Completion	4Q FY 1982	4Q FY 1982
Phase II Initiation	4Q FY 1982	1Q FY 1983
ACAP Program Completion	2Q FY 1985	3Q FY 1985

Because of the highly successful Phase I effort by both contractors completing on cost and schedule and the fact that the Phase II options could be exercised as originally negotiated without change to scope of work and funding, the Phase II options were exercised in fourth quarter FY 1982 rather than first quarter FY 1983, which should lead to program completion one quarter earlier.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63216A

Title: Synthetic Flight Simulators

DOD Mission Area: #552 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Demonstration

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	5980	3522	13986	11274	Continuing	Not Applicable
DB34	Rotor System Integration Simulator (RSIS)	2616	3311	5216	3319	Continuing	Not Applicable
DB39	Flight Simulator Components	3364	211	8770	7955	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Army, the other Services, and other Federal Agencies (e.g., the National Aeronautics and Space Administration, Federal Aviation Administration, and the National Transportation Safety Board) need an engineering simulator to reduce development cost of rotorcraft systems. This will be accomplished by examining advanced technology systems and components, and examining systems and man-machine interfaces early in the development cycle, in the Engineering Simulator, before hardware development. In addition, a systems and component simulation capability is needed which will permit analysis of aircraft accident cases for use in accident-prevention programs and for testing proposed aircraft improvements for fielding aircraft before they are applied to the aviation fleet. The Army, as the lead Service for helicopter research and development, is participating in a joint program with the National Aeronautics and Space Administration (NASA) in developing a highly versatile, high-fidelity, ground-based, rotorcraft simulator to support ongoing and future helicopter development efforts. The investigation of conceptual designs to include preliminary and detailed design trade-offs, mission capabilities, support of flight test planning, and man-machine/workload evaluations is an essential and analytical tool for Army Aviation development. This simulation capability will provide the first real opportunity to accommodate nap-of-the-earth experiments through simulation. Project DB34 meets the Army's and the US Government's need for an Engineering Simulator that supports past, current, and future helicopter development. Project DB39: Provides the Army a means to meet the need to improve pilot training, improve safety, and reduce operating cost. To meet these goals, the use of flight simulators is being increased. The problem is, however, that current visual technology used in simulation, does not provide Army pilots the visual cues necessary for them to operate their aircraft and engage targets, in a nap-of-the-earth (NOE) environment. This visual development effort will provide the Army the simulated visual capability for training in infrared systems, various target acquisition systems, day, night, in simulated NOE, in adverse weather, and, moreover, all done safely and at a greatly reduced cost in flight simulators. Both projects in this program are part of the Army's Technology Thrust into soldier man-machine interface.

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Program Element: #63216A

Title: Synthetic Flight Simulators

DOD Mission Area: #562 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Demonstration

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	5980	3522	13986	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5980	3522	8278	Continuing	Not Applicable

FY 1984: The Army requires the Research Simulator (DB34) to be ready in mid-1985 versus planned delivery in late 1986. \$1.1 million was added to meet contract requirement for the earlier delivery. The Army accelerated the development of the AH-64 Combat Mission Simulator. The concomitant visual system development (DB39) for that simulator requires the Army to advance the visual development by \$5.1 million only in FY 1984.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable

E. (U) RELATED ACTIVITIES: Program Element 64217, Synthetic Flight Training Systems, and 62209A, Aeronautical Technology. The Army rotorcraft simulator utilizes the National Aeronautics and Space Administration Vertical Motion Simulator at the NASA Ames Research Center as the basic motion platform. Duplication of effort is avoided by close coordination with the other Services on a continuing basis through joint program reviews, exchange of technical data and reports, The Technical Cooperation Program (TTCP), NASA research and technology committees, and the North Atlantic Treaty Organization (NATO) Advisory Group on Aerospace Research and Development (AGARD).

F. (U) WORK PERFORMED BY: DB34 is managed at the Aeromechanics Laboratory (NASA-Ames), Moffett Field, CA, by the Research Technology Laboratory of the US Army Aviation Research and Development Command. DB39 is managed by the Project Manager, Training Devices, Orlando, FL, who is collocated with the Naval Equipment Training Center.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) DB34 — Rotor System Integration Simulator (RSIS): Numerous studies, including those by the Army Scientific Advisory Panel (ASAP) an ad hoc working group on research facility requirements for nap-of-the-earth (NOE) day/night visual flight studies, recommended that the Army, as the lead Service for helicopter research and development, place increased emphasis on research and development in helicopter flying qualities using ground-based simulation. Use of ground-based simulation techniques in helicopter development will permit more detailed evaluation of

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Program Element: #63216A

Title: Synthetic Flight Simulators

DOD Mission Area: #552 — Environmental and Life
Sciences (ATD)

Budget Activity: #2 — Advanced Technology
Demonstration

engineering concepts before a commitment to aircraft hardware, will compress development time, and will reduce cost. Under a joint Army — NASA agreement, the RSIS expands the capabilities of the NASA Vertical Motion Simulator. This agreement will minimize costs of a high-fidelity simulator, and obtain increased technical expertise in the development of this Aeronautical Engineering Research Facility. In FY 1982, the Army signed a contract with American Airlines for the development of the Advanced Cab (Notional Aviation Cockpit) and Visual System (Out-the-Window Computer Generated Display) for the RSIS. Also, the Motion Generator System Development was completed. This highly advanced motion system will enable this research simulator to duplicate the movement of an actual aircraft. Contract development for the advance cab and visual system was initiated, and initial integration of the motion generator system began. FY 1983: Initial integration of advance cab and visual system to motion base, rotor system motion generator completed and delivered. FY 1984: Engineering of advance cab and visual system completed and delivered. Begin full system simulation checkout and verification of accuracy of simulation facility.

2. (U) DB39 — Flight Simulator Component: This project provides for the development and demonstration of advance flight simulation techniques and components for incorporation into the design of future simulators, and for improving training capabilities of current simulators. Full consideration is given to the accomplishment of the program through cooperative development with Navy and Air Force laboratories. This effort is directed to the development of visual simulation components designed to provide full mission training capability for nap-of-the-earth (NOE) flight, navigation, gunnery, and survivability in a combat environment. The current program includes preliminary design studies and brassboard demonstration for the development of wide-angle, high-resolution, high-pictorial-detail visual simulation techniques that provide large frontal and downward angle viewing for NOE flight, and integrate multiple viewpoint sensor displays which are vitally needed for simulating weapon systems tactical missions and crew integration training. Technology includes computer-generated image (CGI) edge management techniques for full mission simulation. In FY 1982, the Army entered contracts with General Electric, Honeywell Inc., and Singer Link, for each to develop and demonstrate its respective CGI System. Also, fabrication of an interim odern Titus Light Valve Projector was initiated for use in phase II, of the Two-Phase Visual System Component Development Program (VSCDP), FY 1983, complete Phase I of the VSCDP and initiate phase II, leading to a visual system for the AH-64 combat mission simulator. FY 1984 effort will continue phase II of VSCDP with critical design review and coordination of production, engineering planning, and integrated logistical support for the developed visual system into the AH-64 Combat Mission Simulator. Visual technology developed in this program will be applied to all Air and Ground Base Simulators to improve training and reduce training and acquisition cost.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63218A

Title: Airdrop Equipment and Techniques

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2058	1684	2031	5004	Continuing	Not Applicable
D242	Airdrop Technology Demonstration	- 0 -	- 0 -	1148	2160	Continuing	Not Applicable
D266	Airdrop Equipment and Techniques	2058	1684	883	2844	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports technology demonstration and advanced development of airdrop equipment and techniques to reduce airdrop aircraft vulnerability to enemy air defenses, to improve operational capability to conduct airborne assaults including Rapid Deployment operations, and to provide an improved airdrop resupply capability for both Airborne and conventional forces of all Services. Advancement of personnel and cargo parachutes, airdrop containers, and other aerial delivery equipment is included. Both the High Technology Light Division and Air-Land Battle 2000 concepts rely heavily on the use of airdrop for resupply of units deep within the territory of the enemy. Thus, this program element provides a vital link between research and engineering of airdrop equipment and techniques. Specific deficiencies addressed are deficits in strategic airlift, insufficient airdrop survivability, inaccurate delivery of airdrop forces and materiel, and inability to airdrop large weapons and combat support systems. Efforts are focused on new airdrop equipment and techniques which are transferred from Program Element #62210A (Airdrop Technology) for demonstration of technical, operational, and economic feasibility prior to final development and fielding as airdrop equipment.

NOTE: In previous years' submissions, this program consisted of a single project (#D266) titled Airdrop Equipment and Techniques. The addition of Project #D242 and the title changes will enhance overall program management.

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Program Element: #63218A

Title: Airdrop Equipment and Techniques

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2058	1684	2031	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	2695	1688	2084	Continuing	Not Applicable

Reduction of \$637 thousand in the FY 1982 funding level is the result of reprogramming of funds to higher priority Army requirements. The funding decrease of \$4 thousand in FY 1983 resulted from pro rata application of general Congressional reduction to the RDTEA appropriation. The FY 1984 reduction of \$53 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Program Elements #62210A (Airdrop Technology) and #64218A (Airdrop Equipment Development); Joint Technical Airdrop Group that coordinates Army program elements with other Services' program elements to assure that there is no unnecessary duplication of effort within DOD; Joint Air Movements Board; North Atlantic Treaty Organization (NATO), Air Transport Working Party; Air Standardization Coordinating Committee, Working Party 44; Mutual Weapons Data Exchange Agreements with France, Germany, and Korea; United States/Germany Non-Major Items meetings.

F. (U) WORK PERFORMED BY: Foster-Miller Inc., Waltham, MA, AAI Corp., Baltimore, MD; Sandia National Laboratories, Albuquerque, NM; Electronics Warfare Laboratory, Fort Monmouth, NJ; US Army Yuma Proving Ground, AZ; US Army Natick Research and Development Laboratories, Natick, MA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D242 — Airdrop Technology Demonstration: This project provides for the design and modeling of components, subsystems, and technological demonstrators that have a potential application to a variety of similar airdrop equipment and techniques. There are two tasks that comprise this project in the near term: Drop Zone Assembly Aids Systems (electro-magnetic) to permit rapid location and identification of airdropped materiel and rapid assembly of airborne units and Ultra-High Level Container Airdrop System to provide the capability to airdrop supplies from an

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Program Element: #63218A

Title: Airdrop Equipment and Techniques

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

altitude of 7600 meters with an accuracy of 200 meters. FY 1982 accomplishments (included in project D266 previously): Conducted engineering design tests of the Ultra-High Level Container Airdrop System, and awarded a contract for the final design of the container shell. Continued feasibility demonstration and advancement at Electronic Warfare Laboratories of the Drop Zone Assembly Aids for all-weather use and awarded a contract for the development of alternate Heading/Distance and Very Low Frequency concepts. FY 1983 program included in project D266. FY 1984 program: Fabricate prototype components of the Ultra-High Level Container Airdrop System, conduct flight tests to demonstrate aerodynamic and structural adequacy and transfer to advanced development. Complete the design of Drop Zone Assembly Aids system for all-weather conditions, fabricate prototype models quantities, and initiate Level II testing. This is a continuing program.

2. (U) D266 — Airdrop Equipment and Techniques: This project provides for the advanced development of airdrop materiel and systems. There are five tasks scheduled under this project in the period FY 1983-1984. Not all of these, will be ongoing concurrently. The tasks are: (1) Drop Zone Assembly Aids Systems (Visual) to permit rapid assembly of airborne units; (2) Airdrop Controlled Exit System to solve the problem of excessive drop-zone dispersion for heavy-drop, platform loads; (3) Bundle Airdrop System (C-141) to permit the airdrop of supplies and personnel from an aircraft during a single pass over the drop zone; (4) Heavy Drop Rigging System to enhance rigging and derigging of platform loads; and (5) High-Speed Airdrop Container, which will permit the delivery of up to 500 pounds of supplies from high-speed fighter aircraft flying at airspeeds up to mach 0.99 and at altitudes as low as 200 feet. FY 1982 accomplishments: Awarded a contract for the development of a Bundle Airdrop System for the C-141. Completed advanced development of the Staged Personnel Parachute with Accompanying Bundles and transferred to Engineering Development. Successfully completed Level I development tests of the Airdrop Controlled Exit System. Completed the Concept Evaluation Program tests of the commercially obtained Drop Zone Assembly Aids System for use in visual weather conditions and conducted an In-Process Review. FY 1983 program: Conduct investigation of recovery systems and demonstration testing of container for Ultra-High Level Container Airdrop System. Complete developmental specifications, purchase demonstrator models of electromagnetic hardware, and prepare for Development/Operational II Tests of the Drop Zone Assembly Aids System. Continue development of the Drop Zone Assembly Aids System for visual and clear conditions to include completion of advanced development of materials for personnel assembly. Conduct Operational Test I of Airdrop Controlled Exit System. Monitor contract for development of hardware for Bundle Airdrop System (C-141). FY 1984 program: Complete Advanced Development and transfer to Engineering Development. Drop Zone Assembly Aids System (visual) and Airdrop Controlled Exit System. Conduct Level I development and operational tests of Bundle Airdrop System for C-141 aircraft and transfer to Engineering Development. Initiate development of Heavy Drop Rigging System. Continue design analysis and prepare for design tests of the High-Speed Airdrop System. This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63220A

Title: Advanced Rotorcraft Technology Integration (ARTI)

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development
(ATD)

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	- 0 -	2027	13413	26583	42023
D325	Advanced Rotorcraft Technology Integration (ARTI)	- 0 -	- 0 -	2027	13413	26583	42023

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This advanced development effort is required to demonstrate the integrated/automated cockpit and crewmember/machine interface technology necessary for future rotorcraft survivability and mission effectiveness on the Air-land and Air-land Battle 2000 battlefields. Its proposed activities are a continuation of exploratory development programs and will be in direct response to the existing major Army technology thrust of significantly improving the soldier-machine interface. Feasibility, operational acceptability, and risk of a single aviator cockpit will also be demonstrated and evaluated. A single aviator cockpit would significantly increase aircraft combat utilization and, therefore, combat effectiveness. Advanced cockpit technology using very high speed integrated circuits, advanced displays, automatic flight control systems, voice interactive technology, and digital avionics, coupled with sensor fusion and improved architecture, promise to reduce crewmember workload, increase survivability (due to reduced exposure time), increase capability in nap-of-the-earth, night and adverse weather conditions, increase aircraft availability, significantly improve supportability, and reduce weight (approximately 800 pounds) and cockpit space requirements. These improvements will substantially increase productivity (i.e., targets serviced per day) by as much as a factor of 10. This analysis and flight demonstrator program is a major contributor to the development of the Light Helicopter Series (LHX) family of affordable, small, lightweight (approximately 8000 pounds gross weight) rotorcraft planned to replace the Army's rapidly aging fleet of UH-1, OH-58, OH-6, and AH-1 helicopters in the mid-to-late 1990s. The LHX family will consist of two versions (LHX-Scout/Attack and LHX-Utility) using common dynamic components for affordability and improved supportability. The LHX addresses more than half the Army aviation materiel deficiencies identified by the recent Army Aviation Mission Area Analysis (AAMAA). The technology demonstrated during this effort will benefit other future new systems and preplanned product improvement (PPI) efforts.

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Program Element: #63220A

Title: Advanced Rotorcraft Technology Integration (ARTI)

DOD Mission Area: #563 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development
(ATD)

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	- 0 -	- 0 -	2027	39996	42023
Funds (as shown in FY 1983 submission)	- 0 -	944	14060	26100	41104

No funding existed in FY 1982. The FY 1983 decreased funding reflects the results of Congressional reduction without prejudice in the FY 1983 Appropriations Act. The FY 1984 decreased funding is a result of Army reprioritization and major program restructuring as well as reduction in anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Concept and program formulation efforts have been conducted by the Directorate for Advanced Systems, Headquarters, US Army Aviation Research and Development Command (AVRADCOM), under Program Element #62209A (Aeronautical Technology), Project #AH76. Project personnel maintain close liaison with other military services, industry officials, and user representatives as well as participate in Joint Working Groups. The Research and Technology Laboratories, AVRADCOM, have prepared a comprehensive Technology Development Plan (TDP). This effort has been coordinated with the other military services, Army Human Engineering Laboratory, and the Army Electronics Research and Development Command to insure full application of the generic technology base program and preclude duplicative efforts. Department of the Army Headquarters is also pursuing the potential for a joint service program.

F. (U) WORK PERFORMED BY: The work will be performed by the Research and Technology Laboratories and Avionics Research and Development Activity of the Aviation Research and Development Command (AVRADCOM). The principal laboratories involved are located at Moffett Field, CA, Ft. Eustis, VA, and Ft. Monmouth, NJ. Overall program direction and coordination will be provided by the Directorate for Advanced Systems, Headquarters, AVRADCOM, St. Louis, MO, prior to transition to a Project Manager's Office.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D325 — Advanced Rotorcraft Technology Integration (NEW START): The Advanced Rotorcraft Technology Integration (ARTI) Program is a major supporter to permit the full exploitation of all available advanced technology for the development of the Light Helicopter Series (LHX) which will replace the Army's rapidly aging fleet of UH-1, OH-58, OH-6 and AH-1 aircraft beginning

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Program Element: #63220A

Title: Advanced Rotorcraft Technology Integration (ARTI)

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development
(ATD)

in the mid-to-late 1990s. Results of this technology integration demonstrator are necessary to reduce risk and provide data for initiation of engineering development for the Light Helicopter Series (LHX) in FY 1987 with the goal of a mid-1990s initial operational capability (IOC). Two competitive contracts will be awarded in FY 1984 for initiation of advanced automated/integrated cockpit design to include target acquisition and navigation data. Beginning in FY 1985, the automated/integrated cockpit design will be mocked up and extensive analysis conducted to evaluate different suites of nap-of-the-earth, night/adverse weather navigation, communication, and weapons management for decreased pilot workload, greater mission capability, and survivability. This will be followed by modification of an existing helicopter for flight demonstration of the advanced automated/integrated cockpit in FY 1987. Project completion is scheduled for FY 1987, in time for technology transfer to full-scale engineering development of the LHX family of light rotorcraft.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63221A

Title: Nap-of-the-Earth Aviation and Navigation Equipment

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1830	1494	1424	2098	Continuing	Not Applicable
DB96	Aircraft Navigation & Control Equipment	- 0 -	- 0 -	811	1731	Continuing	Not Applicable
D312	Nap-of-the-Earth Essential Equipment	1830	1494	613	367	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This element supports the advanced development hardware necessary to insure that Army helicopters can operate in the future battlefield against a sophisticated threat. Advanced development is conducted in promising areas in order to resolve key technical, cost and/or schedule uncertainties before entering Full-Scale Development. Project DB96 is aimed at development of a Combat Support Air Traffic Management System (CATMANS) to provide the Army with a modern, highly mobile, functionally adaptable air traffic control system capable of enhancing Army aircraft survivability and improving aviation effectiveness while operating in a low-visibility, high-threat environment. This project contributes to the major Army thrust in Distributed Command, Control, Communications and Intelligence (C²I). Project D312 supports the development of new equipment to allow effective helicopter operations at nap-of-the-earth (NOE) altitudes and permit self-deployment of helicopters. Current efforts include the Airborne Target Handoff System (ATHS), Self-Deployment Navigation capability, and Core Communications, Navigation, Identification (CNI) for Integrated Digital Avionics System (IDAS). The ATHS employs digital burst transmission so that target information from a scout helicopter can be instantly converted into firing information by an attack helicopter. It also provides inter/intra-aircraft data communications capability utilizing existing tactical radios. ATHS is a critical component of scout and attack (AH-64) helicopters. The Self-Deployment Navigation effort will provide an extended-range navigation capability for selected Army aircraft to navigate long distances over land or water, or a combination thereof, in support of the Rapid Deployment Force (RDF). Core CNI for IDAS is a continuous effort which is geared to advance the system architectures and products of the avionics technology base program to specific aircraft applications. The outputs of the IDAS effort include validated Interface Control Documents, Form, Fit and Function (F²) specifications, and MIL-STD-1553 multiplex architectures and software protocols which will be provided to aircraft system prime contractors for Full-Scale Engineering Development (FSED) to insure avionics system interoperability/standardization across the Army fleet.

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Program Element: #63221A

Title: Map-of-the-Earth Aviation and Navigation Equipment

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	1830	1494	1424	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	2336	1899	8932	Continuing	Not Applicable

1. (U) FY 1982 — \$506 Thousand decrease resulted in cancellation of the Multiple Antenna Unit and the Form, Fit, Function (F³) AHRS programs. Included in FY 1982 funds is \$55 thousand for a new effort in the Self-Deployment Navigation program, which is considered critical to the Rapid Deployment Force (RDF) concept.

2. (U) FY 1983 — \$405 thousand decrease was the result of reprogramming to a Compartmented Program and pro rata application of general Congressional reductions to the RDTE,A appropriation.

3. (U) FY 1984 — Net decrease of \$7508 thousand is due to deferment or reduction of programs totaling \$7691 thousand and the addition of \$200 thousand for Self-Deployment Navigation. Decrements include deferred contractual effort for the Combat Support Air Traffic Management Systems (CATMANS) (\$445 thousand), deferred AD start of Multifunction CO₂ NOE Sensor (\$887 thousand), and reduced funding for Core Communications, Navigation and Identification (CNI) for the Integrated Digital Avionics System (IDAS) (\$6579 thousand). CATMANS is a new start in FY 1984. The remaining reduction of \$17 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Related programs of the Air Force, Navy, Federal Aviation Agency, and other organizations are monitored by the Army through committees and working groups such as Air Standardization Coordination Committee, Working Party 53; Data/Communications Technical Coordinating Committee, JINTACCS. Cost reduction is pursued through joint developments and hardware standardization. This program element is related to Program Elements #62202A (Aircraft Avionics Technology) and #64201A (Aircraft Avionics). There is no unnecessary duplication of effort within the Army or Department of Defense.

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Program Element: #63221A

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Title: Nap-of-the-Earth Aviation and Navigation Equipment

Budget Activity: #2 — Advanced Technology Development

F. (U) WORK PERFORMED BY: Rockwell-Collins, Cedar Rapids, IA; US Army Avionics Research and Development Activity, Fort Monmouth, NJ

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D896 — Aircraft Navigation and Control Equipment (NEW START): Provides advanced development of the Combat Support Air Traffic Management System (CATMANS) to enhance Army aircraft survivability while operating in a high threat environment. CATMANS will support logistics, Special Electronic Mission Aircraft (SEMA), Medical evacuation, and other Service aircraft between corps and division areas under all weather conditions. It will enhance employment of air and ground forces during visual and instrument meteorological conditions. The design is modular and adaptable so that the system can be configured for enroute and terminal air traffic control and airspace management applications with a minimum of standard equipment modules. CATMANS addresses stated user deficiencies: the bulkiness of equipment, lengthy installation and setup times, and the need for continuous manning of equipment. CATMANS will increase mobility by 30%; NBC survivability of crew by 90%; data exchange capability by 100%; and aircraft monitoring accuracy. FY 1984 is a new effort for the CATMANS program. Prepare development plan and award contract for prototype system design effort. Prepare Request for Proposal for FY 1985 award of hardware contract. Prepare Coordinated Test Plan.

2. (U) D312 — Nap-of-the-Earth Essential Equipment: Provides the basis for future engineering development of subsystems which enhance the helicopter's nap-of-the-earth operations and long-range navigation capability. The Airborne Target Handoff System (ATHS) will provide a light-weight, reliable, and securable method to exchange target data between Scout (AHIP), Attack (AAH), Ground Fire Support Teams (FIST), and TACFIRE. Develop a supplemental navigation capability for AH-64 Apache, UH-60 Blackhawk, and CH-47 Chinook aircraft, identified capable of self-deployment over long distances. Core Communications, Navigation, Identification (CNI) for the Integrated Digital Avionics System (IDAS) is a continuous effort which is geared to progress the system architectures and products of the avionics technology base program (e.g. ADAS, NNAPS, etc.) to specific aircraft program applications (e.g., UH-1 modification, etc.). FY 1982 efforts included completion of prototype hardware fabrication; completion of contractor portion of DT 1 testing; completion of DT/OT 1 independent evaluation plan; issuance of draft Coordinated Test Plan (CTP); and support of integration in the Advanced Helicopter Improvement Program (AHIP) of the ATHS. Selected OMEGA as the primary candidate for Self-Deployment Navigation. In FY 1983, complete DT 1 flight tests of ATHS and initiate OT 1 and achieve Limited Production (LP) approval. Flight test OMEGA/VLF systems to develop a performance specification, and award contract for Self-Deployment Navigation System. In FY 1984 support ATHS integration effort in AHIP and evaluate next generation RF communication links. Plan for ATHS LP contract for AHIP. Complete contract for Self-Deployment Navigation System and perform DT/OT 1 (or equivalent) flight test program. Continue coordination with user aircraft project managers on installation requirements for Self-Deployment Navigation System. Initiate efforts to meet the CNI requirements of the IDAS LOA.

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Program Element: #63221A

Title: Map-of-the-Earth Aviation and Navigation Equipment

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63306A

Title: Terminally Guided Projectiles

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1997	6795	18849	47439	Continuing	Not Applicable
D174	Lethal Emitter Attack	- 0 -	- 0 -	- 0 -	939	Continuing	Not Applicable
D232	155mm Fire Forget Munitions	- 0 -	6795	18849	48500	Continuing	Not Applicable
D236	Terminal Guidance System	1997	- 0 -	- 0 -	- 0 -	- 0 -	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Fire Support Mission Area Analysis (FSMAA), conducted by the United States Army Field Artillery School (USAFAS), has indicated that the single most important deficiency within the Field Artillery (FA) is "insufficient munitions lethality." This study further indicated that this deficiency can be totally rectified by employing highly accurate projectiles that can sense a hard target and destroy the target. These projectiles are termed Fire and Forget (FAF). The use of FAF munitions increases artillery effectiveness while decreasing vulnerability. In addition, further benefits accrue from reductions in logistical resupply. The effort to be undertaken under this line item is intended to develop such projectiles by means of a competitive demonstration of available technologies. A Mission Element Need Statement (MENS) has been prepared, and a Letter of Agreement (LOA) will be prepared simultaneously with system selection. This program develops "Smart" autonomous munitions for the 155mm weapons system which is the primary direct support field artillery weapon and the most numerous artillery weapons system within both U.S. and NATO allied forces. While other projects develop smart munitions for other weapons systems (i.e., SADARM in 8" and the terminally guided weapon in MLRS), this project represents the only 155mm smart munitions development effort. This project also represents the advanced development implementation of the self-contained munitions technological thrust.

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Program Element: #63308A

Title: Terminally Guided Projectiles

DOD Mission Area: #553 — Engineering Technology (ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	1997	6795	18849	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	1997	6814	23610	Continuing	Not Applicable

The funding decrease of \$19 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE,A appropriation. The decrease of \$4761 thousand in FY 1984 funding results from reprogramming to support higher priority Army projects.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This development relies on extensive technology pursued under other programs; among them are: The Advanced Indirect Fire System (AIFS), an exploratory development program jointly funded by DARPA and DA under PE #ARPA-3806 and IL162603AH18 (Large Caliber and Nuclear Technology) respectively. The AIFS program was coordinated with the USA Missile Command and the AF Armaments Laboratory, Eglin AFB; the Sense and Destroy Armor (SADARM) projectile being developed under PE #63628 D276 (SADARM); and the Spin-Stabilized Guided Projectile and Canard Homing Artillery Modular Projectile (CHAMP) being developed under PE #62603 AH18 (Large Caliber and Nuclear Technology) and PE #63628 D007 (Field Artillery Ammunition and Fuze Development). These programs complement but do not duplicate work in this program element.

F. (U) WORK PERFORMED BY: Contractors for the FY 1983 demonstration will be selected by a special in-process review (IPR) in January 1983. Work performed in programs listed in para E above includes: Sanders Associates, Nashua, NH; Honeywell Corp., Minneapolis, MN; Aerojet Corp., Azusa, CA; Martin Marietta Corp., Orlando, FL; Raytheon Corp., Bedford, MA; US Army Armaments Research & Development Command, Dover, NJ — In-House Agency.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D236 — Terminal Guidance Systems: This project is structured to further the development of advanced terminal homing systems for application to guided projectiles. The principal effort is the development of a radio frequency (RF) seeker that will permit the attack of RF emitters such as air defense radars, artillery-locating radars, and target acquisition radars. FY 1982 funding

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Program Element: #63306A

Title: Terminally Guided Projectiles

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

supported seeker component testing and evaluation in support of the 8-inch guided projectile (PE 63306 D174). The project is not funded in FY 1983 and FY 1984.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: D232 — 155mm Fire-and-Forget Munitions

a. (U) Project Description: Provides funding to demonstrate competitive concepts in 155mm Smart Munitions, for initiation of an advanced technological demonstration of two or more 155mm smart munition candidates. The project is designed to satisfy the first priority fire support deficiency identified in the Fire Support Mission Area Analysis.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Not funded.

(2) (U) FY 1983 Program: A special in-process review will be held in January 1983 to select candidate munitions for competitive development. Initial hardware design and fabrication of seekers and kill mechanisms and preliminary evaluation of components will be initiated.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Seekers will be extensively tested in helicopter captive flight tests to measure performance in a variety of topological environments including the US, Europe, and the Middle East. Seekers will be tactically configured to fit a 155mm projectile. Gun-hardened designs will be fabricated and tested. Microwave integrated circuitry will be developed and integrated together with seekers and lethal mechanisms into all-up projectiles. Candidate munitions being developed in FY 1984 will have been selected in a 1983 In-Process Review; thus final selections are unknown. Candidates include seekers of the millimeter wave and/or infrared type which have previously been demonstrated in other projects. Guidance and control mechanisms include thrust vector control, fins or canards, and explosive strips. Kill mechanisms include self-forging-fragment submunitions, shaped charges, and hemispherical charges.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: To be determined at January 1983 special in-process review (IPR).

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63313A

Title: Missile/Rocket Components

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2311	9157	20568	54801	Continuing	Not Applicable
D085	Demonstration of Advanced Radar Techniques (DART)	- 0 -	- 0 -	1931	2425	3481	7837
D086	Anti Low Level Sig Tgt	- 0 -	- 0 -	- 0 -	4851	Continuing	Not Applicable
D087	Missile Rocket Components	2311	50	3582	- 0 -	Continuing	Not Applicable
D259	Microelec for Air Defense Demo	- 0 -	517	- 0 -	1378	Continuing	Not Applicable
D260	Adverse Environ Seeker	- 0 -	- 0 -	- 0 -	5516	17979	23495
D261	Fiber Optics Guidance	- 0 -	8590	6820	11131	- 0 -	26541
D262	Indir Fire Two-Way Link	- 0 -	- 0 -	- 0 -	1406	23842	25248
D263	Kinetic Energy Missile	- 0 -	- 0 -	1931	5626	10205	17762
D264	Single Penetrator KE	- 0 -	- 0 -	- 0 -	5031	17208	22239
D265	SHORADS Follow-on	- 0 -	- 0 -	- 0 -	5229	Continuing	Not Applicable
D269	Adverse Envir Cmd Guid	- 0 -	- 0 -	- 0 -	2652	24446	27298
D271	Very High Speed Integrated Circuits (VH-SIC) Quiet Radar	- 0 -	- 0 -	5054	4754	9709	19517
D272	Very High Speed Integrated Circuits (VH-SIC) Imaging Infrared Seeker	- 0 -	- 0 -	1250	4802	41968	47820

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Mission Area Analysis (MAA) deficiencies stated by the US Army Training and Doctrine Command (TRADOC) require materiel development solutions for product improvements to existing systems and new systems concepts to provide: detection systems with low probability of intercept and reduced vulnerability to antiradiation missile threat and electronic counter-countermeasures; cost reduction of missile components and systems; a survivable ground- or air-launched antitank system to meet the emerging threat; a kinetic energy penetrator to defeat heavy armor; and advanced seekers for application to direct or indirect fire missiles in the antitank role. This program element provides the mechanism to prove that hardware and software components developed in exploratory development do demonstrate capabilities suitable for transition into materiel acquisition. Many of the projects support the Self Contained Munitions thrust, one of the five new Army technology

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Program Element: #63313A

Title: Missile/Rocket Components

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

thrusts. Projects to be funded in FY 1984 are to: (1) develop a radar antenna for an international cooperative program designed to demonstrate advanced radar techniques for future short-range air defense surveillance; (2) develop cellular manufacturing techniques which will allow introduction of low-cost robots into the manufacture of missile and rocket components and systems; (3) demonstrate a concept which uses a missile layable fiber optics link with an imaging infrared or television seeker to provide electronic countermeasure immunity via the link, in-flight target acquisition, greatly improved accuracy, and target kill assessment for indirect fire against armor targets; (4) demonstrate a beamrider-guided, hypervelocity missile suitable for helicopter or lightweight ground vehicle launch that delivers a kinetic energy penetrator against advanced tanks; (5) demonstrate a radar with low probability of intercept and noncooperative target recognition capability which uses very high speed integrated circuits (VHSIC) to enhance signal/data processing, reduce size, and improve reliability; and (6) develop a low-cost, imaging infrared, fire-and-forget seeker, particularly for the antiarmor role.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2311	9157	20568	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	311	9181	14024	Continuing	Not Applicable

The funding increase of \$2000 thousand in FY 1982 is a result of reprogramming for advanced technology investigations for antitactical missile applications. The funding decrease of \$24 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. The funding increase of \$6544 thousand in FY 1984 is a result of restructuring the Advanced Technology Demonstration program in line with current priorities and technology thrusts.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program element is related to efforts conducted in Program Element #62303A (Missile Technology); Program Element #63452F (Very High Speed Integrated Circuits); Program Element #63781A, Project #D235 (Missile Countermeasure Technology), and Program Element #63363F (Tactical Air-to-Surface Weapons). Duplication is avoided by active participation of laboratory personnel in interagency working groups, liaison visits to agencies/activities involved in related efforts, the free exchange of information among agencies, and the structuring of the program toward unique Army needs in tactical missiles. Exploratory development work accomplished in missile technology feeds directly into this program element. This program capitalizes on the DOD Very High Speed Integrated Circuits (VHSIC) technology effort. US Army Missile Laboratory

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Program Element: #63313A

Title: Missile/Rocket Components

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

personnel are actively participating in the DOD VHSIC technology program. Both Kinetic Energy Missile and Imaging Infrared Seeker projects are of interest to the Air Force and have the potential of becoming joint Army/Air Force programs, but no formal agreements currently exist.

F. (U) **WORK PERFORMED BY:** Contractors for these advanced development projects will, in main, be selected as a result of competitive solicitations. None have been selected at this time. The US Army Missile laboratory, US Army Missile Command, Redstone Arsenal, AL, will be the lead Army laboratory and will play a strong integrating role in each of these projects. One project in particular, Fiber Optics Guidance, will be performed with major in-house involvement in design and evaluation phases.

G. (U) **PROJECTS LESS THAN \$10 MILLION IN FY 1984:**

1. (U) **D085 — Demonstration of Advanced Radar Techniques (DART) (NEW START):** This is a self-contained munitions thrust project to assist NATO countries (Denmark, France, Italy, Netherlands, and United Kingdom) in the feasibility demonstration of advanced radar techniques for application to short-range air defense. The US contribution will be the antenna for the radar. In FY 1984 the antenna specifications and interface requirements will be developed, and the design will be initiated.

2. (U) **D087 — Missile/Rocket Components:** In FY 1984, this project has the objective to use group technology approaches to develop manufacturing "cells" for fabrication of groups of identical missile/rocket components. The development of cellular manufacturing technologies will provide flexible, low-cost manufacturing systems and allow efficient introduction of robots into the missile manufacturing environment. Models will be developed and validated for converting job shops into cellular manufacturing systems. In FY 1984, the following technologies will also be investigated for future application to advanced antiarmor weapon systems: warhead/cueing integration, seeker counter-countermeasures, control systems, and FOG/Tank Breaker man-machine interface. In FY 1982 this project provided the beginning of the new project on Microelectronics for Air Defense Demonstrator, which was shifted to project D259 in FY 1983. In FY 1983, D087 will be used for a one-year task in laser counter-countermeasures.

3. (U) **D288 — Microelectronics for Air Defense Demonstration:** This project has been delayed following its first year of analysis due to higher priority requirements for funding resources.

4. (U) **D281 — Fiber Optics Guidance:** A self-contained munitions thrust, this project was begun in FY 1983 to demonstrate the use of fiber optics guidance of a missile in the attack of high-value point targets (e.g., tanks) without exposing the launch platform to direct fire. The missile will have a terminal homing capability and a target kill assessment via the fiber optics link that is immune to countermeasures. A high degree of operator aids by the ground station computer, such as automatic navigation, map display, potential target highlighting tracking (after operator lock-on) will provide high engagement rates out to 10 kilometers. Demonstration of fiber optics link performance, system specification, major missile baseline

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Program Element: #63313A

Title: Missile/Rocket Components

DOD Mission Area: #653 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

design decisions, and procurement of initial prototype hardware for the gunner's station display, control, and computer were conducted under exploratory development. The program schedule will be based upon early flight tests and corrective design action. After procurement of other critical components, the initial flight test in mid-FY 1983 will be a near vertical launch to demonstrate launch, wing deployment, and boost-sustainer motor operations. The second flight test in late FY 1983 or early FY 1984 will add the fiber optic data link and limited seeker to demonstrate integrity of the link during vertical launch and flight. In FY 1984 the first three or four of fifteen guided flight tests will be conducted to demonstrate all critical system functions. A digital target-tracking capability and automatic target lock-on will be demonstrated along with a stabilized television seeker. Multiple, simultaneous missile flights under control of the gunner's station will be simulated and demonstrated.

5. (U) D263 — Kinetic Energy Missile (NEW START): This new project is designed to demonstrate the effectiveness of a beamrider-guided, kinetic energy missile to destroy extremely heavy armor by launch from either a helicopter or the ground. In FY 1984 a hypervelocity rocket motor will be tested; a beamrider guidance technique (an alternate to the Air Force technique) will be tested, and the competing techniques will be jointly evaluated with the Air Force. A kinetic energy penetrator will be developed, and flight test demonstrations will be initiated.

6. (U) D271 — Very High Speed Integrated Circuits (VHSIC) Quiet Radar (NEW START): A self-contained munitions thrust project, this project has the objective to develop a track-while-scan quiet radar that uses VHSIC chips to enhance signal/data processing, reduce the volume required for circuitry, and improve reliability and maintainability of the system. The quiet radar, for use with short-range air defense weapons, will have a pencil beam with ultra low sidelobes which makes it virtually immune to detection and jamming. In addition to its low probability of intercept, anti-antiradiation missile, and electronic counter-countermeasure features, the radar will have a noncooperative target recognition capability added. In FY 1984, concept options related to noncooperative target recognition will be evaluated; processing methods and architectures will be investigated; VHSIC chip set(s) will be applied to the processor design; the radar design will be respecified based upon test results from exploratory development hardware, VHSIC chip capabilities, and the selected noncooperative target recognition techniques; and the radar design will be initiated.

7. (U) D272 — Very High Speed Integrated Circuits (VHSIC) Imaging Infrared Seeker (NEW START): A self-contained munitions thrust project. This project is to develop a low-cost, fire-and-forget seeker for antitank missiles, particularly for the fiber optics guided missile (FOG-M) concept or a HELLFIRE product improvement. This project capitalizes on FY 1982 and FY 1983 joint Army/Air Force exploratory development of scanning focal array technology and the Department of Defense VHSIC technology program. The addition of VHSIC technology to the seeker increases the computing capability to implement the algorithms of optimal flight control laws for lock-on-before-launch capability. During FY 1984, two competitive contracts will be awarded for seeker design and development.

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Program Element: #63313A

Title: Missile/Rocket Components

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63314A

Title: High-Energy Laser Components

DOD Mission Area: #554 — Directed Energy Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	- 0 -	14001	42423	Continuing	Not Applicable
D055	Air Defense HEL Sys	- 0 -	- 0 -	- 0 -	21980	Continuing	Not Applicable
D057	Close Combat Laser Assault Wpn	- 0 -	- 0 -	14001	20443	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides advanced technology demonstrations of the feasibility of laser weapon concepts to permit informed decisions on further systems development. The ultimate objective of the current project is to develop a Close Combat Laser Assault Weapon (CCLAW) that will assist in redressing the numerical superiority of Warsaw Pact forces. The CCLAW will be integrated into existing combat vehicles such as the Bradley Fighting Vehicles, Light Armored Vehicles, and helicopters for employment with maneuver forces in a manner similar to conventional direct fire weapons. A feasibility demonstration program, ROADRUNNER, currently in the design stage, will culminate in The CCLAW will have the potential to defeat the enemy forces' ability to by rapidly locating and destroying the enemy's systems employed on both ground and airborne weapon systems at militarily significant ranges. Extensive wargaming and other analyses have shown that the capability to rapidly engage large numbers of targets from all directions, together with a large magazine, provides a significant force multiplier in overcoming the Warsaw Pact force imbalance.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	- 0 -	- 0 -	14001	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	- 0 -	33116	42581	Continuing	Not Applicable

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Program Element: #63314A

Title: High-Energy Laser Components

DOD Mission Area: #554 — Directed Energy Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

The funding decrease of \$33116 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act. The funding decrease of \$28580 thousand in FY 1984 is a result of deletion of the Forward Area Laser Weapon project and revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Army technology development supporting CCLAW (i.e., wavelength agility and target acquisition) and other future demonstrations is being pursued under Program Element #62307A (Laser Weapons Technology). Two laser demonstrator programs concerned with electro-optical countermeasures are being pursued under Army Program Element #63762A, Project #DK16 and Air Force Program Element #63745F, Project #2222. Close coordination is maintained and duplication of efforts is avoided through joint participation in program review meetings, technical meetings, and proposal evaluations.

F. (U) WORK PERFORMED BY: The primary contractors are: Westinghouse Electric Corporation, Baltimore, MD; Texas Instruments, Inc., Dallas, TX; United Technologies Research Center, East Hartford, CT; General Electric, Binghamton, NY; and Lockheed Missile and Space Company, Huntsville, AL. The responsible developing organization is the US Army Missile Command, Redstone Arsenal, AL.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: D057 — Close Combat Laser Assault Weapon (CCLAW) (NEW START)

a. (U) Project Description: The CCLAW project will be accomplished in two phases. The initial phase, ROADRUNNER, will develop a demonstrator integrated into an M-2 Bradley Fighting Vehicle. The ROADRUNNER will be subjected to a systematic series of field demonstration tests to determine its functional capability and to provide data necessary to credibly predict effectiveness against the projected threat. Primary emphasis during the tests will be on weapon system fire control. The will be demonstrated. Timelines will be extremely short in order for the laser weapon to be able to capitalize on "almost zero" time of flight of the laser beam. Both fully automatic and manually aided operation will be tested. The results of these field tests will be used in the definition of requirements for the second phase, the development of a prototype CCLAW that will satisfy the Army need to increase combat effectiveness of the maneuver force.

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Program Element: #63314A

Title: High-Energy Laser Components

DOD Mission Area: #554 — Directed Energy Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: The preliminary design for the ROADRUNNER was completed in the fourth quarter, and planning for the field demonstration tests was initiated. This program was funded in Program Element #62307A (Laser Weapons Technology) in FY 1982.

(2) (U) FY 1983 Program: Detailed design of the ROADRUNNER will be completed, and hardware fabrication initiated. Modifications to the Bradley Fighting Vehicle to accommodate the ROADRUNNER system will be completed. The test plan for the field demonstration tests will be completed. This program is funded in Program Element #62307A (Laser Weapons Technology) in FY 1983 at Congressional direction.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request:

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
Complete demonstrator acceptance test		Added
Initiate field demonstration		Same
Complete field demonstration		Same
Initiate prototype development		Same
Complete prototype development		Same

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63324A

Title: Army Development and Employment Activity (ADEA)
(formerly the High Technology Test Bed)

DOD Mission Area: #551 -- Electronic and Physical
Sciences (ATD)

Budget Activity: #2 -- Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	7300	38620	29055	Continuing	Not Applicable
D180	ADEA Distributed Command Post	- 0 -	7300	13603	11176	- 0 -	32079
D247	ADEA Distributed Command, Control, and Communications Processing Technology	- 0 -	- 0 -	11577	11663	Continuing	Not Applicable
D249	ADEA Technology Thrust Integration	- 0 -	- 0 -	3861	- 0 -	Continuing	Not Applicable
D252	ADEA Concepts and Technology Evaluations	- 0 -	- 0 -	9579	6216	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element was formerly called the High Technology Test Bed (HTTB) and is a continuation and expansion of that program. The purpose of ADEA is to examine technologies with significant impacts on combat power and to coordinate development of operational concepts and materiel requirements for future fielding. It addresses the need to modernize the Army's most deployable units, the light divisions. The war-fighting capability of these divisions falls to match those of our potential foes and their client states. The Army's answer is the newly designed High Technology Light Division (HTLD) organization, which will be equipped to meet the competing demands of strategic deployability, high mobility, and significantly improved firepower. Using the Army Development and Employment Activity (ADEA) to accelerate the development and acquisition process, the Army plans to field and equip a prototype HTLD in FY 1986. Initial emphasis in evaluating the HTLD will address the requirement to reduce the vulnerability of the division command post to attack. The current command post consists of collocated personnel and communications required to plan, coordinate, and execute the tactical commander's battle plans. This centralization of personnel and equipment is vulnerable to detection and destruction. This tactical deficiency can be overcome by spreading the various command post elements on the battlefield using improved communications links to maintain effectiveness. Even greater effects can be accomplished by application of distributed communications technology to assemble operational and intelligence data from multiple sources and distribute it selectively to the correct location in a timely manner to affect the battle. The command and control and intelligence-gathering problems become even more complex as the commander's area of influence increases with his requirement to see deeper under the "Air-Land Battle" doctrine. High-technology programs to address these problems are key to the effectiveness of light divisions. The ADEA will allow close scrutiny of new technology thrusts, allow user/developer hand-in-glove evolution of the Army's future command and control systems, and will promote development and evaluation of operational

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Program Element: #63324A

Title: Army Development and Employment Activity (ADEA)
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DOD Mission Area: #551 — Electronic and Physical
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Budget Activity: #2 — Advanced Technology Development

concepts and materiel requirements to obtain accelerated fielding of new systems. Systems that will be evaluated under the ADEA program in FY 1984 include those which address Electronic Warfare and chemical, biological, and logistical operations shortfalls. This program element contributes directly to the major Army technology thrusts. ADEA will provide the testbed for many thrust demonstrations and the integration of these thrusts with each other and onto the future battlefield.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	- 0 -	7300	38620	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	- 0 -	10711	8261	Continuing	Not Applicable

The FY 1983 request was reduced to \$7300 thousand by Congress, all of which was applied to project #D180, ADEA Distributed Command Post. Project #D273, (HTTB Road Runner), and Project #D274 (HTTB-Netted Radar), are unfunded. In FY 1984, project #247 (ADEA Distributed Command, Control, Communications and Processing Technology) initiates a major effort to enhance data gathering, as well as the assembly, processing, and timely distribution of intelligence and operational information for all Army forces. Since much of this evolutionary acquisition effort will take place using testbed facilities at Ft Lewis, it is appropriately added to this program element. Project #D278 (HTTB-Low Cost Vehicle Navigation), has been included in Project #252 (ADEA Concepts and Technology Evaluations) whose principal function will be to evaluate small unit operational concepts and technology that have significant impact on near and mid-term combat power.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program supports the Army's overall initiative to improve combat readiness and effectiveness by infusion of available technology into tactical units through High Technology Test Bed operations. Related developments include: Program Element #64727 (Command and Control), Project #D184 (Tactical Computer System/Terminal); Program Element #63723 (Command and Control), Project #D185 (Military Software Standardization) and Project #D186 (Military Computer Family); Program Element #63713 (Army Data Distribution System), Project #D370 (PLRS/JTIDS Hybrid); Program Element #23726 (Advanced Field Artillery Data System), Project #D322 (Advanced Field Artillery Tactical Data System); Program Element #64712 (USA Tactical Command, Control, and Communications Systems Engineering), Project #D323 (System

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Program Element: #63324A

Title: Army Development and Employment Activity (ADEA)
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Engineering for Tactical C³ Systems); Program Element #6270: (Communication/Technology), Project #AH92 (Communication Electronics); Program Element #62746, Project #A094 (Tactical ADP Technology); Program Element #63707 (Communications Development), Project #D246 (Tactical Communications Development) and Project #D437 (Tactical Communications Systems Development); Program Element #62703 (Combat Surveillance, Target Acquisition, and Identification), Project #DH93 (Combat Surveillance, Target Acquisition and Identification); Program Element #63710 (Night Vision Advanced Development), Project #DK70 (Night Vision Advanced Development); Program Element #63762 (Electronic Warfare Feasibility Demonstration); Project #DK15 (Advanced Communications Electronic Countermeasures Demonstration) and other programs. There is no unnecessary duplication of effort between ADEA and any of the related programs.

F. (U) WORK PERFORMED BY: US Army Communications-Electronics Command, Ft Monmouth, NJ, and Army Development and Employment Activity, Ft Lewis, WA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D249 — ADEA Technology Thrust Integration (NEW START): This project provides technical integration of new thrust technology products into a coordinated demonstration of advanced materiel and operations concepts. The new technology thrusts (Very Intelligent Surveillance and Target Acquisition; Distributed Command, Control, Communications and Intelligence; Self-Contained Munitions; Soldier-Machine Interface; and Biotechnology) are to be organized in an integrated demonstration to assess the overall force multiplier value of these high technologies, to identify possible impact of technologies on operational concepts, and to determine technical and organizational interface issues implied in exploiting these technologies. Funding is for the technical work necessary to integrate the demonstration and to assess system interoperability. ADEA provides the vehicle for organizing, integrating, and conducting many of the thrust demonstrations. FY 1984 efforts will initiate the integration effort. FY 1985 funds will be provided to continue with the demonstrations which are planned for the FY 1986-1987 timeframe.

2. (U) D252 — ADEA Concepts and Technology Evaluations (NEW START): This project merges operational concepts and new technology applications and evaluates and evolves their utility and impact on combat forces. Evaluation will include simulation, studies, and testing of small units in operational environments. This project provides funding to purchase test hardware to equip small units and support elements for operational concept testing and materiel evaluation of systems impacting combat power in the near to mid-term. Systems to be evaluated under this project in FY 1984 include new electronic warfare and jamming systems adapted to light force scenarios, improved individual equipment for use in chemical and biological environments, individual lift devices, palletized loading systems and tactical support trailers that have the capability of reducing the numbers of support vehicles to one-half their present level, and other systems selected for significant command, control, and firepower potential with light forces.

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Program Element: #63324A

Title: Army Development and Employment Activity (ADEA)
(formerly the High Technology Test Bed)

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: D180 — ADEA Distributed Command Post

a. (U) Project Description: This project will develop a prototype distributed command post to be deployed and evaluated at the 9th Infantry Division in FY 1985. In order to reduce command post vulnerability, sufficient data must be distributed to appropriate locations to deny the enemy a critical target element whose destruction would disable the command and control process. To accomplish this distribution, adequate communications (voice, data, and graphics) and data processing must be developed. To satisfy these requirements, existing Army inventory items, Advanced Development/Engineering Development prototypes, technology-based prototypes, and commercially available (off-the-shelf) hardware and software processes will be utilized to the maximum extent possible. Hardware/software interfaces and applications software will be developed as necessary. High technology will be stressed to the extent that it potentially adds a significant enhancement of distributed command and control operational capability. The initial system will include up to nine command and control elements which will enable experimentation in a user environment. Fourteen elements will be provided by the end of FY 1985 for the final evaluation. One additional facility will be maintained at the developing agency to allow for technical evaluation and testing of equipment assemblies and facilitate day-to-day laboratory operations. The intent of this project is to provide prototype hardware which will provide a functional capability to the 9th Infantry Division and provide a baseline for evolutionary development which will continue under Project #D247 (ADEA Distributed Command, Control, and Communications Processing Technology).

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: New start in FY 1983.

(2) (U) FY 1983 Program: The architecture for the distributed command post will be completed. This process will be accomplished in close coordination with the 9th Infantry Division and will lead to the initiation of detailed engineering of the command and control facilities, including the required communications system/equipment. Identification of the inventory equipment, development system, and commercial items required for implementation of the command and control facility will be completed in order to minimize procurement leadtimes. Hardware and software development efforts will be initiated.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: As equipment and software modules become available, system integration efforts will commence. Close coordination with the 9th Infantry Division will continue to insure that the evolving design is meeting the required military utility. To that end, when sufficient hardware and software elements exist to provide a meaningful demonstration, the 9th Infantry

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Program Element: #63324A

Title: Army Development and Employment Activity (ADEA)
(formerly the High Technology Test Bed)

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

Division will test the configuration to determine the adequacy of the existing design and provide recommendations for changes or enhancements as necessary. Software/hardware development efforts will continue and will be integrated into the system.

(4) (U) Program to Completion: The integration of communications/automatic data processing components, including software enhancements, will be completed. Engineering design testing and validation will be completed and the 9th Infantry Division will perform final user tests. FY 1985 is projected as the final year of this effort and will culminate with the completion, testing and acceptance by the 9th Infantry Division of their distributed command post consistent with their Operational and Organizational Concept.

c. (U) Major Milestones: Not Applicable.

2. (U) Project: D247 — ADEA Distributed Command, Control, and Communications Processing Technology (NEW START)

a. (U) Project Description: The objective of this project is to identify the critical elements of technology to be investigated, designed, and developed to establish a command, control, and communications (C³) system that supports the Air-Land Battle 2000 concept developed by the US Army Training and Doctrine Command (TRADOC). This project will build upon the output of Project D180 (Distributed Command Post), will add new technology as it becomes available, and will result in the objective system for the 1990s. This system must be hardened and secure, must allow dispersed operation, contain no critical nodes, and fully utilize distributed data processing to provide maximum redundancy and survivability. To meet this challenge, C³ systems must be capable of providing: fully adaptive communicative network management allowing any user to obtain access or share necessary battlefield information with users on the same or different networks; robust information distribution to mobile users through alternate routing; increased survivability of command functions by minimizing critical controlling nodes; and user access to an entire data information network through distributed processing.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: New start in FY 1984.

(2) (U) FY 1983 Program: New start in FY 1984.

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Program Element: #6324A

Title: Army Development and Employment Activity (ADEA)
(formerly the High Technology Test Bed)

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: A program to design, engineer, integrate and test the interoperability and effectiveness of an integrated distributed C³ capability with other new thrust efforts, such as Very Intelligent Surveillance and Target Acquisition (VISTA), will be initiated. This effort will result in a total system capability for transfer to user testbeds and demonstrations. Additionally, a series of experiments will be initiated with the Defense Advanced Research Projects Agency (DARPA) for the evaluation of technologies for command and control applications for the battlefield of the 1990s and beyond. Techniques and products to be evaluated include distributed processing architectures and protocols, distributed data bases and their integration with supporting distributed communications, echelons of computing portability, and user interface technologies.

(4) (U) Program to Completion: Efforts initiated in FY 1984, in particular, those integrating Distributed C³ efforts with VISTA and the cooperative DARPA/Army progress in Distributed C³, will be continued with emphasis on preparing to bring the system and equipment to user-oriented testbeds to determine their military utility. TRADOC participation in these integration and demonstration efforts will insure that the capabilities provided are consistent with the needs of the battlefield envisioned in the Air-Land Battle 2000 concept. Enhancements to the 9th Infantry Division capability, completed under Project #D180, will be incorporated into this project subsequent to FY 1985.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63602A

Title: Advanced Land Mobility Systems Concepts

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advance Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	7127	7745	7650	28254	Continuing	Not Applicable
D118	Combat Vehicle Technology	7127	7745	7650	28254	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The program constitutes a critical step in defining combat vehicle systems of the future. The objective is to demonstrate and evaluate innovative future combat vehicle configurations and technology in vehicle testbed hardware to determine initial feasibility and military potential. Programs include the Elevated Kinetic Energy Tank Gun Test Bed initiated in FY 1980, the Tank Test Bed and the Surrogate Research Vehicle initiated in FY 1982, the Infantry Fighting Vehicle Test Bed and the Integrated Countermeasures Test Bed planned for FY 1985, and a series of testbeds beginning in FY 1985 based upon the ongoing Future Close-Combat Vehicle Concept Studies. Prior to FY 1982 this Program Element also funded the High Survivability Test Bed Vehicle (HSTV-L) and the High Mobility Agility Test Bed (HIMAG), which have led to definition of the Mobile Protected Gun System.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	7127	7745	7650	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	9217	7767	30865	Continuing	Not Applicable

FY 1982 decrease due to reprogramming to higher priority Army requirements. FY 1983 decrease of \$22 thousand due to pro rata application of general Congressional reductions to the RDTE, A appropriation. FY 1984 decrease due to Army decision to fund higher priority near term readiness needs.

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Program Element: #63682A

Title: Advanced Land Mobility Systems Concepts

DOD Mission Area: #883 — Engineering Technology
(ATD)

Budget Activity: #2 — Advance Technology Development

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Specific programs related to the technical areas of this program element are: PE #62601A (Tank and Automotive Technology); PE #63631A (Combat Vehicle Turret and Chassis); PE #61102A (Defense Research Sciences); PE #62105A (Materials); PE #62603A (Large Caliber and Nuclear Technology); PE #62733A (Mobility Equipment Technology); PE #62618A (Ballistic Technology); PE #63102A (Materials Scale-Up); PE #62608A (Tank Gun Development and Tank Ammunition); PE #63621A (Combat Vehicle Propulsion Systems); PE #23735A (Combat Vehicle Improvement Program); and PE #63624A (Mobility). Close coordination is maintained with other Services and Government agencies to preclude duplication of effort. Research and development information concerning combat, combat support, tactical, and special purpose vehicles is also being exchanged via data agreements with allied countries.

F. (U) WORK PERFORMED BY: Primary in-house efforts will be performed by the US Army Tank-Automotive Command, Warren, MI. Other in-house efforts will be performed by the US Army Armament Research and Development Command, Dover, NJ; US Army Test and Evaluation Command, Yuma, AZ, and Anniston Army Depot, Anniston, AL; Night Vision Laboratory, Ft Belvoir, VA. Contractors involved are: Pacific Car and Foundry Co., Renton, WA; Cadillac Gage Co., Warren, MI; ARES Inc., Ft Clinton, OH; CAI Industries, Barryinton, IL; General Dynamics, Warren, MI; Food Machinery Corp., Minneapolis, MN; Rheinmetall, Dusseldorf, GE; Litton Systems Inc., Woodland Hills, CA; and Pietzsch Corp., Karlsruhe, GE.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D118 — Combat Vehicle Technology: The Army has a continuing need to increase its ground combat vehicle technology base through examination of innovative concepts and unique weapon system configurations. While theoretical studies provide a great deal of information, it is mandatory that hardware testbed vehicles be fabricated to be evaluated under actual field conditions. Specific tasks included in this project include: (1) the Elevated Kinetic Energy Test Bed, demonstrating the potential of an automatic large caliber gun version of the Improved TOW missile, provides a fire-and-forget, variable-height weapon system, firing from defilade positions; (2) the Tank Test Bed providing system evaluation of the following technologies and issues: advanced optics/sensing for surveillance and target acquisition, automatic loading for the 120mm gun, and reduced crew size/new tank assignments; (3) the Surrogate Research Vehicle, a combat vehicle simulator mounted on an M1 Tank chassis, providing user evaluations of various crew sizes and locations and advanced optics/surveillance systems for future tank configurations. Future efforts include the initiation of the Advanced Infantry Fighting Vehicle Test Bed, the Integrated Countermeasure Test Bed, and the Future Close-Combat Vehicle Test Bed. FY 1982 accomplishments: (1) The fabrication, integration, and assembly of the Elevated Kinetic Energy Test Bed was completed, and a safety test of its 400-round autoloader was successfully conducted. This testbed underwent an air loading test and was transported to Yuma Proving Ground, AZ, via C-130 tactical aircraft. (2) The contract for the Tank Test Bed was awarded. Its design was initiated and required Government-Furnished Equipment (GFE) procured. (3) Surrogate Research Vehicle: The detailed design began in April 1982 with the M1 tank chassis being modified in-house and the turret and electronics being developed under contract. Design of the turret and chassis has been completed. The Government-Furnished Equipment has been procured and shipped to the contractor. FY 1983 goals: (1) The Elevated Kinetic Energy Test Bed

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Program Element: #63882A

Title: Advanced Land Mobility Systems Concepts

DOD Mission Area: #563 — Engineering Technology
(ATD)

Budget Activity: #2 — Advance Technology Development

will be instrumented in October 1982, with weapon safety certification tests beginning in November 1982, followed by a 4- to 6-month Government technical feasibility test. (2) The Tank Test Bed funds will provide for continuation of the design and fabrication effort, brassboard autoloader testing, and a full-scale mockup/space claim assessment. (3) Surrogate Research Vehicle will be completed, and Phase I crew configuration tests will be conducted at Fort Knox, KY, beginning February 1983. FY 1984 goals: (1) Fabrication and assembly of the Tank Test Bed will be completed; contractor checkout and safety certification will be conducted; and Follow-on government evaluation at Fort Knox, KY, will be initiated. (2) Surrogate Research Vehicle: advanced vision/surveillance hardware will be integrated into the vehicle, and Phase II target acquisition and surveillance testing will be conducted at Fort Knox, KY.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63606A

Title: Landmine Warfare/Barrier Development

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	9923	9298	14218	11453	Continuing	Not Applicable
D006	Landmine Warfare Development	1170	2968	3535	4520	Continuing	Not Applicable
D606	Countermine and Barrier Development	8753	6330	10683	6933	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides for advanced development of mine componentry and concepts applicable to landmine warfare, the family of scatterable mines (FASCAM), and improved conventional and special-purpose mines. Mines continue to provide a formidable obstacle to assist in overcoming the massive tank threat posed by the Warsaw Pact. Mines are required to fortify natural obstacles such as defiles, rivers, and urban areas in order to delay, canalize, and interdict attacking forces and enhance the performance of direct and indirect fire weapons. Efforts include a microcomputer, sensors, fuzes, target discrimination logic and anticountermeasure devices to improve the overall effectiveness of mines and make minefields more difficult to traverse. New concepts include controllable minefields to allow for greater battlefield mobility of friendly troops, and an off-route antitank mine for use along highways and roads and in urban terrain. Identified components, when integrated, will provide a system of mines and delivery means meeting Army requirements. This landmine warfare development project is contributory to the major Army technology thrust in self-contained munitions. Soviet and Warsaw Pact doctrine advocates the large-scale use of landmines in both offensive and defensive operations. In support of this doctrine, the Soviets have developed mechanized devices which rapidly lay minefields having a variety of complex mine fuzes. Mutually supporting countermine devices and techniques are required to meet the threat. This program element also improves the Army countermine capabilities by investigating and exploiting materials, techniques, and equipment evolving from exploratory development. These investigations will ultimately lead to enhanced tactical mobility by detecting and neutralizing the barrier potential of enemy minefields. Also, improved field fortifications techniques are being devised and evaluated to improve battlefield survivability of friendly forces by hardening combat positions.

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Program Element: #63608A

Title: Landmine Warfare/Barrier Development

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	9923	9298	14218	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	10768	9324	11335	Continuing	Not Applicable

The reduction of \$845 thousand in the FY 1982 funding level is a result of reprogramming to higher priority Army requirements. The funding decrease of \$26 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. The funding increase of \$2883 thousand in FY 1984 results from program realignment, within the countermine area, to accommodate revised development schedules and expanded program objectives. Major FY 1984 increases are for development of a dedicated counterobstacle vehicle (COV) test bed in cooperation with the government of Israel, initiation of the M1 tank integrated countermine system, and remote minefield detection projects. Increases in this project were largely offset by a reduction in requested funding for Program Element #63619A, Project #D606.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Exploratory development for this program is conducted in Program Elements #62603A (Large Caliber and Nuclear Technology) and #62733A (Mobility Equipment Technology). Systems advanced development for landmine warfare and barrier systems is performed in Program Elements #63619A (Countermine and Barriers) and #64618A (Landmine Warfare). Developmental information is coordinated and exchanged between the Services by the Tri-Service Joint Technical Coordination Group for Bombs, Mines, and Clusters to avoid duplication of effort. The Department of Defense Armaments Munitions Requirements and Development Committee monitors the scatterable mine program to avoid Service duplication. Countermine efforts are closely coordinated with the Armament Systems Directorate, US Army Armament Research and Development Command (ARRADCOM), Dover, NJ, the responsible agency for the Army Mine Program.

F. (U) WORK PERFORMED BY: Armament Systems Directorate, ARRADCOM, Dover, NJ, is responsible for management of Landmine Warfare systems and components. The US Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA, is assigned responsibility for Countermine and Barriers.

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Program Element: #63996A

Title: Landmine Warfare/Barrier Development

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D006 — Landmine Warfare Development: During FY 1982, development of an antitank electronic assembly consisting of a microcomputer and multiple influence sensors was initiated. Development of the antitank electronic assembly will be continued in FY 1983 with work initiated on an influence sensor for an antipersonnel mine. During FY 1983 and FY 1984, development efforts will continue on improved lethal mechanisms, counter-countermeasure components, increased area mine system components, target signature analysis, controllable minefield components, mine sensor components and analysis of systems effectiveness.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: D606 — Countermine and Barrier Development

a. (U) Project Description: This project provides improved countermine and barrier capabilities by exploiting mature techniques and equipment evolving from exploratory development in Program Element #62733. Items under consideration include: (1) Improved explosive for a fuel-air explosive (FAE) warhead (CANETIP); (2) a dedicated counterobstacle vehicle (COV) test bed; (3) improved combat shelters; (4) remote minefield detection/neutralization, (5) countermine robotic system, (6) improved line charge, (7) vehicle off-road mine detection system (VORMIDS), (8) scatterable mine detection system, and (9) M1 tank integrated countermine system.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Efforts were continued on the counterobstacle vehicle (COV) test bed, CANETIP, the family of combat shelters, and remote minefield detection.

(2) (U) FY 1983 Program: Work will continue on improved countermine, barrier, and field fortifications concepts, techniques, and components. Advanced development of remote minefield detection systems, combat shelters, CANETIP, and the COV test bed will also continue.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Effort will continue on the joint US/Israeli COV test bed, weaponization of the CANETIP technology to verify improvement over existing mine clearing systems, and remote minefield detection. Remote detection methods include the airborne mine detection system (AMIDS) and an effort to enhance minefield detection using other reconnaissance assets. Work will also be initiated on an M1 tank integrated countermine system and a scatterable mine detection system. FY 1984 funding for this project is higher than originally planned because technology has not matured sufficiently to move into the next stage of advanced development. The increases are largely offset by decreased FY 1984 funding for Program Element #63619A, Project #D606.

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Program Element: #63808A

Title: Landmine Warfare/Barrier Development

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63807A

Title: Joint Service Small Arms Program (JSSAP)

DOD Mission Area: #553 -- Engineering Technology
(ATD)

Budget Activity: #2 -- Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	6597	2709	1737	4747	Continuing	Not Applicable
D627	Joint Service Small Arms Prog	5667	2709	1737	4747	Continuing	Not Applicable
D640	Crew-Served Weapon Dev	930	- 0 -	- 0 -	- 0 -	- 0 -	25030

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This effort provides a coordinated program for the advanced development of the small arms weapon systems required by the joint Services to meet the threat on the battlefield of the foreseeable future. The associated technology advancement in small arms will provide a capability to respond to present and projected requirements to insure that the US fighting man will be adequately armed on the modern battlefield. JSSAP supports the Army close combat light mission area, specifically addressing deficiencies for light forces and special operations forces, and the Marine Corps, Air Force security police, and Navy special operation forces mission areas.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	6597	2709	1737	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5487	3486	3934	Continuing	Not Applicable

Increase of \$1110 thousand in the FY 1982 funding level is the result of a reprogramming to assess the use of dry lubricants in small arms and to complete the maturity phase of the Squad Automatic Weapon program. The funding decrease of \$757 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act and pro rata application of general Congressional reductions to the RDTE, A appropriation. A funding decrease of \$2.187 million in FY 1984 is a result of reprogramming to higher priority Army requirements and a revision of the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #63607A

Title: Joint Service Small Arms Program (JSSAP)

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The technical areas in the program are related primarily to: Program Element #62617A (Fire Control and Small Caliber Armaments Technology) and Program Element #62623A (Joint Service Small Arms Program (JSSAP)). The Joint Service Small Arms Program (exploratory development — 6.2/nonsystem advanced development — 6.3A) was created to assure that there is no unnecessary duplication of small arms effort within the Department of Defense, and that all Service small arms needs are adequately addressed. Full coordination among all the Armed Services is maintained by the JSSAP Management Committee and chartered joint-Service working groups representing the user, developer, and evaluator communities. Program scope and activities are governed by official Memorandum of Agreement on the Management of Multi-Service Systems/Programs/Projects and Department of Defense Directive 5000.1, Major System Acquisition.

F. (U) WORK PERFORMED BY: This program of Nonsystem Advanced Development is under the management of the Joint Service Small Arms Program. The prime in-house developing organization responsible for the program is the US Army Armament Research and Development Command, Dover, NJ, with other major efforts at the Naval Weapon Support Center, Crane, IN, and the Air Force Armament Technology Laboratory, Eglin Air Force Base, FL. Primary contractor support is for the general-purpose heavy machinegun, provided by AAI Corp., Cockeysville, MD.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D627 — Joint Service Small Arms Program: The principal advanced development thrusts are the general purpose heavy machinegun, submachinegun, Close Assault Weapon, and Ammunition. General-purpose heavy machinegun (GPHMG)—A new and greatly improved heavy machinegun with less than half the moving parts, ease of maintenance and training, as well as anticipated higher reliability. Companion high-performance penetrator ammunition is included in the project, which will provide a new capability against threat vehicles. This effort addresses the close combat light mission area deficiencies associated with the need for infantry weapons with improved armor-defeating capability. In FY 1982, a contract was awarded for prototype weapons. In FY 1983, testing of prototype weapons will be initiated and an assessment of the potential for manportability and of the armor-defeating capability conducted. FY 1984 efforts will include completion of the advanced development configuration and development of a draft Joint Service Operational Requirement (JSOR). Submachinegun—A new submachinegun which is compatible with NATO ammunition and provides increased operational effectiveness for special missions. This effort addresses special operations force deficiencies in the close combat light mission area. In FY 1982, testing of demonstrator hardware was completed and a Joint Service Science and Technology Objective (JSSTO) approved. Planned activity in FY 1983 is a contract award, with FY 1982 funds, for development of prototype weapons. In FY 1984, an evaluation of advanced development hardware will be conducted and performance characteristics incorporated into a draft Joint Service Operational Requirement (JSOR). Close Assault Weapon (CAW)—To provide a high-volume-of-fire weapon for ambush, jungle warfare, operation in urban terrain, and base defense. A

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Program Element: #63807A

Title: Joint Service Small Arms Program (JSSAP)

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

Joint Service Science and Technology Objective was approved in April 1982. In FY 1983 a contract will be awarded, with FY 1982 funds, for development of prototype hardware and ammunition, and a draft JSOR will be initiated. These prototypes will be evaluated in FY 1984. Ammunition—This category includes sabot light armor penetrator (SLAP) ammunition, flechettes, special-purpose ammunition and caliber .50 training ammunition. In FY 1982, efforts were initiated on advanced development of 7.62mm sabot light armor penetrator (SLAP) ammunition, which provides some armor penetration capability for the existing M60 machinegun. FY 1983 plans include completion of 7.62mm SLAP/special-purpose ammunition efforts for joint service application and initiation of a flechette advanced development effort. The flechette projectile offers flat trajectory, short time of flight, and greatly improved penetration, while allowing for salvo delivery of projectiles for significantly enhanced hit performance. Testing of caliber .50 training ammunition and completion of an assessment of flechette ammunition will be accomplished in FY 1984.

2. (U) D840 — Crew-Served Weapon Development: This project supports the development and fielding of the Squad Automatic Weapon (SAW). The SAW will provide increased range and effectiveness and replace the two M16A1s currently designated as Squad Automatic Weapons. The FY 1982 effort completes the SAW maturity phase to include: Integrated Logistic Support (ILS); load-carrying equipment and bandoleer efforts; and development of the blank-firing adaptor. The SAW, designated the M249, was type classified 1 February 1982.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63821A

Title: Combat Vehicle Propulsion Systems

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	9120	12882	13189	36537	Continuing	Not Applicable
DG07	Combat Vehicle Engine	7350	9173	9512	25133	Continuing	Not Applicable
D395	Combat Vehicle Transmission	1770	3709	3677	11404	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for advanced technology demonstration of combat vehicle propulsion systems and components. Due to extreme operational requirements, vehicle propulsion systems intended for military use must possess high output, low volume and weight, multifuel capability, and efficiency and durability not normally available on the commercial market. Ancillary components, such as air filtration and cooling systems, must also be provided to enable these systems to operate in the unique military environment. Combat vehicle propulsion systems greater than 500 horsepower are among the longest leadtime development items associated with ground combat vehicles. This program insures that state-of-the-art propulsion system technology unique to military needs is adequately demonstrated. This program also develops key improvements to existing propulsion systems. The Tank-Automotive Command, responsible for this program, maintains continuous dialogue with Government agencies and commercial contractors to preclude any duplication of effort. Below 500 horsepower, commercial engines are exploited for ground vehicle applications. High-performance combat vehicle transmissions have no commercial equivalent.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	9120	12882	13189	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	12897	12918	17622	Continuing	Not Applicable

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Program Element: #63621A

Title: Combat Vehicle Propulsion Systems

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

Reduction of \$3.777 million in FY 1982 funding level is a result of reprogramming to higher priority Army requirements. The funding decrease of \$36 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTEA appropriation. The reduction of \$4.433 million in FY 1984 funding level is a result of an Army decision to fund other high-priority needs and a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Program Elements (PE): PE #62601A (Tank and Automotive Technology); PE #63602A (Advanced Land Mobility System Concepts); PE #62106A (Materials); PE #62733A (Mobility Equipment Technology); PE #63201A (Aircraft Power Plants and Propulsion); PE #63109 (Fuels and Lubricants Advanced Development); PE #63102A (Materials Scale-Up); PE #63626A (Advanced Diesel Engine Technology); and PE #23735A (Combat Vehicle Improvement Program). Foreign state-of-the-art trends in military propulsion systems are monitored by the Tank-Automotive Command, and data are exchanged with allied countries via data exchange agreements. Inter/intra-Service/department duplication of effort is prevented through active planning and coordination of this program at all levels. Program content is subject to continuous review.

F. (U) WORK PERFORMED BY: United States Army Tank-Automotive Command, Warren, MI, is responsible for the development of this program. Major contractors are: Donaldson Corporation, Minneapolis, MN; Cummins Engine Company, Columbus, IN; Detroit Diesel Allison, Indianapolis, IN; General Electric, Pittsfield, MA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) DG07 — Combat Vehicle Engine: The objective of this project is to provide engines to meet Army ground combat mobility goals. The unique operational requirements of combat vehicles most often dictate that propulsion systems and other components be developed under Government auspices. Problems and needs associated with combat fuel consumption are among the most acute to be attacked. Major objectives include: improved fuel economy for increased vehicle range; improved fuel tolerance to allow operation on fuels derived from new primary sources (coal, shale, etc.); improved survivability through higher horsepower-to-weight ratios resulting in enhanced agility; reduced weight and volume resulting in lower vehicular silhouettes; improved reliability, availability, maintainability, and durability; and improved control and driveability. FY 1982 accomplishments: The Adiabatic Engine was shown to be the most fuel-efficient engine in the world after over 500 hours of multicylinder testing. An Adiabatic Uncooled Engine was successfully tested in a military 5-ton truck. Design work on 600-horsepower and 750-horsepower Adiabatic Engines for combat vehicle application was initiated. The LCR-V903 (1000 hp) experimental prototype diesel demonstrated a 1000-horsepower output in turbocompound and nonturbocompound configurations. The self-cleaning air filter successfully completed initial vehicle field tests. FY 1983 goals include (a) Design and fabrication of 600-horsepower and 750-horsepower Adiabatic Engines will be completed. Mechanical and performance development testing of these

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Program Element: #63621A

Title: Combat Vehicle Propulsion Systems

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

engines will commence; (b) Basic component support for the "vee" configuration engine will continue; (c) The LCR-V903 (1000 hp) experimental prototype diesel will undergo heat rejection and combustion heat release tests. Engine performance will be enhanced by variable injection timing and an improved cam shaft. Component development will continue and durability testing will commence; (d) The self-cleaning air filter will be installed in the five Phase I reliability, availability, maintainability, durability (RAM-D) Growth Test Abrams tanks to establish performance potential in production vehicles. FY 1984 goals include (a) Mechanical Integrity and performance testing on first-generation 600-horsepower and 750-horsepower Adiabatic Engines will be completed. Detailed design on advanced prototype second-generation versions will begin to include design changes based on first-generation engine tests; (b) The LCR-V903 (1000 hp) experimental prototype diesel will complete durability testing. Component redesign and test will proceed based on durability test phase results. The self-cleaning air filter RAM-D tests will be completed and the type classification decision made by the M1 Project Management Office; (c) Requests for Proposals for the Advanced Integrated Propulsion System (AIPS) Phase II (Technology Demonstration) will be issued and proposals evaluated. This two-contractor phase will begin in FY 1984 and produce first demonstrator hardware in FY 1989. (d) Design of alternative fuel combustion systems will also be initiated in FY 1984. Together, these programs will make significant progress towards achievement of the Army's mobility goals.

2. (U) D395 — Combat Vehicle Transmission: The objective of this project is to develop and test combat vehicle transmissions and components to meet the unique operational requirements of combat vehicles. The program's goals are to develop cost effective transmissions and components that will: (a) improve compactness; (b) reduce weight; (c) improve reliability, availability, maintainability, and durability; and (d) improve control and driveability. The unique military requirements of combat vehicles dictate that high-speed steering transmissions be developed under Government auspices. FY 1982 accomplishments have included the awarding of contracts for future close combat vehicle propulsion system transmission concept developments, field and laboratory tests of the CVX 650 advanced transmission for vehicles in the 750-horsepower range, and two competitive contract awards for 1000-horsepower transmission concept development. FY 1983 goals include (a) Continue the development of the CVX 650 advanced transmission and conduct durability and steering control testing; (b) plan concept development of 1000-horsepower transmission. FY 1984 goals include (a) Continue work on the development of the CVX 650 advanced transmission and complete durability and steering control testing; (b) complete 1000-horsepower transmission hardware design phase and begin component testing; (c) continue design phase of the advanced, integrated propulsion system transmission. If the proper transmissions are to be available for vehicle integration (present and future), it is essential that this program continue with its critical work.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63631A

Title: Combat Vehicle Turret and Chassis Subsystems

DOD Mission Area: #553 -- Engineering Technology
(ATD)

Budget Activity: #2 -- Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	7056	10115	12183	28310	Continuing	Not Applicable
D014	Combat Vehicle Hull & Turret	3348	2875	7418	14404	Continuing	Not Applicable
D424	Combat Vehicle Track & Suspension	3708	7140	4765	14906	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for advanced technology demonstration of components associated with ground combat vehicle hull, turret, track, and suspension subsystems, and the development and feasibility demonstration of concepts which integrate countermeasures with the ability to detect, locate, and classify threats, and develop and demonstrate more efficient integration of vehicle electrical and electronic systems. Such systems are militarily unique and therefore must be developed through US Army research and development. Major thrust of this program is to acquire the technology necessary to produce more lethal and survivable vehicles. Common goals of all program tasks are increased performance, enhanced survivability and reliability, availability, maintainability and durability (RAM-D), and reduced cost. Results of the program will often lead to product improvements to current Army combat vehicles as well as innovations to be incorporated into new vehicle systems as they are being developed.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (Current requirements)	7056	10115	12183	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	7854	11146	12935	Continuing	Not Applicable

FY 1982 decrease due to reprogramming to higher priority Army requirements. FY 1983 decrease of \$1.031 million is a result of pro rata application of general Congressional reductions to the RDTE,A appropriation (\$31 thousand) and a proposed reprogramming of \$1 million for Compartmented Programs. FY 1984 decrease due to Army decision to fund other high priority Army requirements.

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Program Element: #63831A

Title: Combat Vehicle Turret and Chassis Subsystems

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Program Elements (PE): PE #62105A (Materials); PE #63102A (Materials Scale-Up); PE #62120A (Nuclear Weapons Effects/Fluidics); PE #62601A (Tank Automotive Technology); PE #63602A (Advanced Land Mobility Systems Concepts); PE #62733A (Mobility Equipment Technology); PE #63632B (Armored Combat Support Vehicle Family); PE #63735A (Combat Vehicle Improvement Program); PE #62617A (Small Caliber and Fire Control Technology); PE #62702A (Night Vision Investigations); PE #62716A (Human Factors in Military Systems); PE #62618A (Ballistics Technology); and PE #23735A (Combat Vehicle Improvement Program). Foreign state-of-the-art trends in military propulsion and suspension systems are closely monitored, and technology information is exchanged with allied countries via data exchange agreements. Close coordination and continuous discussion with other Services/Departments preclude duplication of efforts.

F. (U) WORK PERFORMED BY: The Army Tank-Automotive Command, Warren, MI, is responsible for the development and system integration of this program. Major contractors for the program elements include Huntsville Electronics Division of Chrysler, Huntsville, AL; Santa Barbara Research Center, Coleta, CA; Gravier Incorporated, Mountainside, NJ; Standard Products Company, Port Clinton, OH; Firestone, Noblesville, IN; Goodyear Tire and Rubber Company, St. Mary's, OH; Northrup Corporation, Anaheim, CA; Vought Corp, Dallas, TX; Tri-Tech, Inc., Columbia, MD; Daimo Victor Corp, Belmont, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D014 — Combat Vehicle Hull and Turret: The objective of this project is to provide validated components and subsystems and integrate them into combat vehicle hull and turrets to increase performance, survivability, and RAM-D. These efforts will result in lower costs in countermeasures, electrical and electronics systems, logistics, and life support systems. FY 1982 accomplishments: Advanced Countermeasures/Vehicle Integrated Defense System Program demonstrated several subsystems for threat warning and countermeasures. Active and passive countermeasures were evaluated in joint programs with the US Army Armament Research and Development Command (ARRADCOM) and the USAF. A concept design and system specification for a Data Management System (DMS) was completed. The DMS provides integration and artificial intelligence for threat warning countermeasure and crew interface. Advanced Techniques for Electrical Power System (ATEPS) multiplex system in a baseline M1 tank hull was completed and its technical feasibility established. Design of a two-terminal turret system (fire control remote terminal and gunner's crew terminal) was completed and hardware fabrication initiated. FY 1983 goals: (a) The Data Management System hardware and software will be fabricated and integrated with computer-simulated threat warning receivers and countermeasures for test and validation. Crew interface will be optimized through the implementation of advanced visual display techniques and voice synthesis. Several additional threat warning devices and countermeasure reactions will be integrated including millimeter Wave/Radar Warning receivers and the Programmable Countermeasure Dispenser. (b) Vetrionics (the science and technology of electronics applied to vehicles);— A Systems Engineering effort and design of a crew display demonstrator

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Program Element: #63631A

Title: Combat Vehicle Turret and Chassis Subsystems

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

will begin. (c) ATEPS—Installation and test of M1 turret system will be initiated. (d) Advanced Diagnostics-breadboard demonstration hardware for noncontact sensors for engine speed, cylinder fault identification and turbocharger testing to be completed. FY 1984 goals include: (a) Vetronics—continue system engineering effort, initiate development of system architecture demonstrator and testbed demonstration. (b) Advanced Diagnostics—Demonstrate noncontact diagnostic techniques in modified simplified test equipment and develop preliminary system specifications. (c) Life Support Development—Initiate effort to incorporate microclimate cooling hardware, ventilation blower hardware, and hybrid collective NBC protection hardware on testbed vehicles.

2. (U) D424 — Combat Vehicle Track & Suspension: The objective of this project is to provide combat vehicle track and suspension components which meet Army ground combat mobility goals. Problems and needs resulting from higher vehicle speeds, increasing hardware and maintenance cost, plus improving survivability, are the most acute to be attacked. Major objectives include: Near-term thrusts to increase track durability and reduce the maintenance burden and life cycle cost and a long-term thrust to develop a common track system for specific weight classes of vehicles. The approach involves use of laboratory simulation tests, computer math modeling, and full scale vehicle test rigs to demonstrate the performance improvements and verify the technology data base being established for track and suspension systems. Upon successful completion of demonstrator tests, components will be incorporated in future vehicle programs and product improvement programs for existing vehicles. The Tank-Automotive Command, responsible for this program, maintains continuous dialogue with Government agencies and commercial contractors to preclude duplication of effort. FY 1982 accomplishments have been: (a) development of a track pad rubber blowout test for M1 track, (b) successful completion of testing of both forged track and cast track prototypes in the 15-18-ton weight class (Cost analysis was favorable when compared to existing track), (c) completion of testing of components for fluidic dampers with the goal of improving existing track vehicle suspension systems. Fabrication of 36 prototype fluidically controlled dampers was initiated with field testing to be conducted in the next fiscal year. FY 1983 goals include: (a) laboratory test of improved track rubber compounds for the M1 and M60 tanks; (b) in the 45-65-ton class track, complete testing of fabricated replaceable pad track shoes, prototype polyurethane track pads, metal matrix shoes, laminated metal track pads and fabricate a lightweight forged steel track with replaceable pads for the M1 tank; (c) in the 20-40-ton class track, complete fabrication of six vehicle sets and initiate testing; (d) continuation of 14-18-ton cast track testing with goal of attaining at least 9000 miles of track life; (e) improving track retention and control by designing, fabricating, and testing an active track tensioner system; (f) conduct an evaluation of current state-of-the-art tracks and suspensions to determine what existing technology is applicable to future requirements and identify areas where new technology must be developed; and (g) continuation of laboratory and vehicle testing of fluidic dampers with the goal of improving cross-country mobility. FY 1984 goals include: (a) conduct vehicle tests of track rubber compounds for the M1 and M60 tanks; (b) continue work on improved track bushings, track fasteners, and track pin refurbishment; (c) in the 45-65-ton class track, conduct field testing of laminated metal track pins, polyurethane track pads, and metal matrix track shoes; (d) conduct field testing of improved 20-40-ton class track; (e) complete in-house and contractor development of active track tension systems; (f) complete a technical data management system to supply track and suspension design information quickly from an on line system; (h) complete testing on prototype fluidic

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Program Element: #63631A

Title: Combat Vehicle Turret and Chassis Subsystems

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

dampers and initiate design of fluidically controlled rotary dampers; and (f) initiate effort on improved torsion bar development by evaluating new materials and design methodology.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1994: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63636A

Title: Combat Vehicle Armor/Antiarmor

DOD Mission Area: #563 — Engineering Technology (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	9660	8746	14587	Continuing	Not Applicable
D221	Combat Vehicle Survival-Armor	- 0 -	4935	3913	7734	Continuing	Not Applicable
D223	Combat Vehicle Antiarmor	- 0 -	4925	4833	6853	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the Army's close combat mission area by increasing the survivability of our combat vehicles through improved protective armor and by increasing the lethality of our direct and indirect fire antitank systems with improved warheads and projectiles. The program objectives are to develop and demonstrate: (1) vehicle armor which will provide adequate protection for combat vehicles against anticipated ballistic (kinetic energy and shaped charge) threats in the 1988-1998 timeframe and (2) the capability to defeat threat armor in the same timeframe with kinetic energy projectiles and shaped charge (direct fire and top attack) warheads. To accomplish the objectives in armor protection, the program plan is to focus armor technology in high-payoff areas, rapidly integrate technology, provide armor design guidelines, and provide integrated conventional and nontraditional survivability. The antiarmor objectives will be achieved by exploiting emerging shaped charge technology and kinetic energy (KE) projectile technology, hardware demonstration of high potential warheads and KE penetrators, and providing antiarmor weapon design guidelines.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	- 0 -	9660	8746	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	- 0 -	10668	11233	Continuing	Not Applicable

The funding decrease of \$1.026 million in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act. The funding decrease of \$2.487 million in FY 1984 is a result of program realignment and revision of the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #63636A

Title: **Combat Vehicle Armor/Antiarmor**

DOD Mission Area: #553 — **Engineering Technology**
(ATD)

Budget Activity: #2 — **Advanced Technology Development**

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The related projects at the research level (6.1) are: PE #61102A/AH42 (Research in Materials and Mechanics) at the Army Materials and Mechanics Research Center (AMMRC), PE #61102A/AH43 (Research in Ballistics) at the Ballistics Research Laboratory (BRL), PE #61102A/AH60 (Research in Large Caliber Applications), at the Large Caliber Weapons System Laboratory (LCWSL), and PE #61102A/AH49 (Missile and High Energy Laser Research), at the Missile Laboratory (MICOM). The related projects at the exploratory development (6.2) level are: PE #62105A/AH84 (Materials) (AMMRC); PE #62618A/AH60 (Ballistic Technology) (BRL); PE #62603A/AH18 (Large Caliber and Nuclear Technology) (LCWSL); PE #62303A/A214 (Missile Technology) (MICOM); and PE #62601A/AH91 (Tank and Automotive Technology), at the Tank-Automotive Command (TACOM). Related projects at the nonsystem advanced development (6.3a) level: PE #63102/DO71 (Materials Scale-Up Structure Demonstration) (AMMRC); PE #63313A/DO87 (Missile and Rocket Components) (MICOM); and PE #63631A/DO14 (Combat Vehicle Hull and Turrets) (TACOM). Finally at the Operational Systems Development (6.7) level there is one program, PE #23735/D341 (105mm Tank Gun Enhancement Program) (LCWSL). A close relationship is maintained with other Services and Government agencies in order to prevent duplication. Information is also exchanged with several foreign governments under data exchange agreements, a memorandum of understanding, and The Technical Cooperation Program (TTCP). A program plan for the vehicle armor aspect has been prepared by TACOM, and for the antiarmor aspect, BRL has prepared a plan. These plans are intended to assure that the effort is fully coordinated and frequently reassessed to confirm that new discoveries are advanced expeditiously.

F. (U) WORK PERFORMED BY: The work will be performed by the US Army Materials and Mechanics Research Center, Watertown, MA; Ballistic Research Laboratory, Aberdeen Proving Ground, MD; Large Caliber Weapons Systems Laboratory, Dover, NJ; Missile Laboratory, Huntsville, AL; and US Army Tank-Automotive Command, Warren, MI. Contractors are: JPL (Jet Propulsion Laboratory), Pasadena, CA, and SPC (Systems Planning Corporation), Arlington, VA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. **(U) D221 — Combat Vehicle Survival-Armor:** The objective of this project is to develop and demonstrate vehicle armors that will provide adequate protection for combat vehicles against Soviet tank guns and antitank missiles in the 1988-1998 timeframe. Ideally the armors must be of lighter weight than present-day armors. The accomplishment of this project will result in more mobile and more survivable combat vehicles, a major Army objective. Technology gained from this program can be used to provide improved light weight armors for equipment presently fielded in both active and reserve components of the Army. This was a new project start in FY 1983 with the goals of developing and demonstrating new technologies that have maximum potential for exploitation in new and current combat vehicles. Once the technologies are developed, they will be demonstrated in full-scale tests. Initially, efforts will concentrate on a system known as "reactive armor," which appears to have great potential to provide

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Program Element: #63636A

Title: Combat Vehicle Armor/Antiarmor

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

protection against ballistic threats in the 1988-1998 timeframe. The other technology, ceramic armor, will initially be brought on at a somewhat slower rate. It is envisioned that it will be able to both complement and supplement reactive armor without unacceptable weight and space penalties. Development of lightweight armor design methodology will become a large portion of this program. Program goals for FY 1983, FY 1984, and FY 1985 are: (1) focus armor technology in high-payoff areas, (2) provide rapid integration of technology, (3) provide design guidelines, (4) assess effectiveness of armor technology, and (5) integrate conventional and nonconventional survivability. Project milestones are: (1) demonstrate application and exploit reactive armor technology by 1985 and (2) provide lightweight armor design guidelines by 1985.

2. (U) D223 — Combat Vehicle Antiarmor: The objective of this project is to develop and demonstrate the capability to defeat threat armor as represented by the Future Soviet Tank (FST). The four phases of the program are as follows: (1) Demonstrate in two years an improved kinetic energy round that will enable the M1, M60A1, and M60A3 tanks to defeat the FST, (2) demonstrate the penetration capability of soft-launched, rocket-assisted, kinetic energy penetrators against the potential armor of the FST, (3) demonstrate the penetration performance of a top attack warhead that is suitable for 100-125mm missiles or projectiles, and (4) demonstrate a large high-explosive antitank (HEAT) (shaped charge) warhead capable of defeating the frontal armor of the FST. This was a new project start in FY 1983 with the goals of: (a) demonstrating in two years an improved 105mm armor-piercing fin-stabilized discarding sabot-tracer (APFSDS-T) round that will enable the M1, M60A1, and M60A3 tanks to defeat the FST; (b) demonstrating the penetration capability of a soft-launched, rocket-assisted, kinetic energy (RAKE) penetrator against the heavy frontal armor of the FST; (c) demonstrate the penetration performance of a fly-over-shootdown warhead utilizing three-dimensional, nonaxisymmetrical explosive system suitable for 100-125mm missiles or projectiles; and (d) demonstrate an advanced technology 150mm HEAT warhead capable of defeating the frontal armor of the FST. FY 1984 goals include: (a) conduct final demonstration of the improved 105mm APFSDS-T round; (b) develop penetrator designs and operating limits for the kinetic energy (KE) missile and RAKE; (c) develop fly-over-shootdown warhead integration support; (d) design and fabricate laboratory flight body and fuze for the 150mm advanced technology HEAT Warhead; (e) initiate effort to demonstrate the application of tandem warheads in the 150mm size against the frontal armor of the FST; and (f) demonstrate the advanced capability of composite KE penetrators against the FST-type threat.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63637A

Title: Advanced Propulsion/Launch Systems For Munitions

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0* -	- 0* -	628	670	36502	37800
D155	Liquid Propellant Guns/Ammunition Systems	- 0 -	- 0 -	628	670	36502	37800

*This program presently in exploratory development (6.2) is a new start in advanced development (6.3) for FY 1984.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This new start FY 1984 advanced development program will provide technology development and demonstration of a brassboard regenerative liquid-propellant (RGLP) 155mm gun/ammunition system. A regenerative liquid-propulsion device will be designed and incorporated into a 155mm technology demonstrator for ballistic tests to evaluate operational efficiency and maturity of this propulsion concept. Concurrently, a family of liquid propellants for guns will be characterized and evaluated to verify suitability for use in military weapon systems. Liquid propellants (LP) offer substantial advantages over solid propellants. These advantages occur in production, logistics, operations, and demilitarization. In a preliminary life cycle evaluation of liquid propellants by the US Army Armament Research and Development Command (ARRADCOM), with assistance of the US Army Armament Materiel Readiness Command (ARRCOM) and the US Army Materiel Systems Analysis Activity (AMSAA), the advantages of liquid propellant have been identified. One of these advantages is in production, where critical raw materials are not required and where environmentally undesirable byproducts are not produced. Since the proposed production process is automated easily, using commercially available equipment, costs of both facility and propellant are significantly less than comparable solid propellants. Liquid propellants require less volume for storage and may be shipped in bulk quantities. Current liquid propellant candidates are not ignited easily and do not release energy rapidly at atmospheric pressure, thereby providing enhanced safety and reduced weapon system vulnerability. Combat vehicle design will be simplified through use of liquid propellants. Since these propellants can be stored in bulk quantities safely, ammunition storage will be enhanced. Where a projectile is loaded mechanically, automatic loader design will be simplified and rate of fire increased. Potential ballistic improvements include: reduced wear and erosion in gun barrels, reduced muzzle blast and flash, significantly increased muzzle velocities (difference is 25 percent) and capability to soft-launch an acceleration-sensitive projectile; e.g., self-contained munitions. A summary of quantified advantages from liquid propellant use includes: a 60-80-percent reduction in propellant charge costs, a 40-percent reduction in ammunition transport requirements, more than 50-percent increase in ammunition storage on combat vehicles, and safe and uncomplicated propellant demilitarization since liquid propellants are biodegradable.

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Program Element: #63637A

Title: Advanced Propulsion/Launch Systems For Munitions

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands) This is a new start in FY 1984.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Coordination of liquid propellant work among the Army, Navy, and Air Force and Defense Advanced Research Projects Agency is provided through the Joint Service Liquid Propellant Task Group operating under auspices of the Office of the Under Secretary of Defense for Research and Engineering and through technical liaison and briefing of program accomplishments. Coordination within the Army is accomplished through participation in the Army Liquid Propellant Working Group and through direct technical liaison and meetings. There is no unnecessary duplication of effort within the Army or other Department of Defense organizations.

F. (U) WORK PERFORMED BY: The US Army Armament Research and Development Command, Ballistic Research Laboratory, Aberdeen Proving Ground, MD, will direct this effort and perform 35 percent of the work in-house. One major contractor, General Electric Ordnance Systems Department, Pittsfield, MA, and three to five other contractors will perform the balance of work and provide requisite support. Contractors will receive approximately \$400K.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D155 — Liquid Propellant Guns/Ammunition Systems (NEW START): This new start, FY 1984 program provides for technology development and demonstration of a brassboard 155mm regenerative liquid-propellant gun/ammunition system. The first-year effort will include formulation of a detailed plan for conducting this five-year advanced development program. Results of the FY 1983 exploratory development Program will be evaluated and exploited in developing the concept for the 155mm brassboard liquid-propellant gun demonstrator. Potential contractors with the technical expertise, equipment, and facilities to support liquid-propellant demonstrator development will be identified. Conceptual layout/design will be initiated for the 155mm regenerative liquid-propellant technology demonstrator utilizing current liquid-propellant. This effort will consist of several subtasks including propellant chamber design configuration, selection of component geometry and location, design layout of the breech-loading mechanism, development of projectile loading scheme, and selection/design of effective recoil mechanism for the liquid-propellant demonstrator. This effort will provide for layout/design integration for this brassboard system. From this conceptual design, component sections of the demonstrator will be fabricated, tested, and evaluated for system compatibility and integration. Other supporting efforts will include development, test, and qualification of enhanced-performance liquid propellants. The formulation and development of optional production methods for liquid propellants will be actively pursued. In FY 1982 exploratory development efforts were conducted encompassing improved propulsion concepts and completion of a system study for the application of a liquid propellant for a self-propelled artillery weapon in Program Element #62618A, Ballistics Technology. The study shows that the greatly reduced propellant costs warrant logistic support, and increased operational capabilities are achievable with liquid-propellant munition systems. In FY 1983 exploratory development efforts will be continued to include test firings of a 105mm regenerative liquid-propellant concept using a testing fixture, testing of the regenerative propulsion concept at ambient and low temperatures; evaluation of an

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Program Element: #63637A

Title: Advanced Propulsion/Launch Systems For Munitions

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

improved igniter device for use in a liquid-propellant gun; and extensive evaluation and characterization of candidate liquid propellants under a wide variety of environmental conditions. This program element will begin in FY 1984 and provide development and demonstration of brassboard (test fixture) regenerative liquid propellant for 155mm gun/ammunition. A regenerative liquid propulsion device will be designed and incorporated into a technology demonstrator for ballistic tests to evaluate operational efficiency and maturity of this propulsion concept. In subsequent years, continue advanced development phases to completion of the 155mm self-propelled howitzer demonstration firings. Target date for completion of demonstration firings is fourth quarter 1989.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63710A

Title: Night Vision Advanced Development

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	33591	33739	29189	46430	Continuing	Not Applicable
DK70	Night Vision Advanced Development	23722	22803	20754	30093	Continuing	Not Applicable
DK86	Night Vision for Airborne Vehicles	2642	3269	4997	8416	Continuing	Not Applicable
DK87	Night Vision for Combat Vehicles	7227	7867	3438	7921	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Army needs an improved capability to fight at night and during adverse weather or limited visibility. The covert or passive capability to find, identify, and destroy enemy targets with modern weapon systems cannot exist without the technology advanced developments of this program element. The objective of this program is to apply the advances in technology to new and improved night vision and electro-optical systems for the infantry (individual soldiers) antiarmor and air-defense missile systems, combat and mechanized infantry vehicles, and scout and attack helicopters. The needs will be specifically satisfied through the evolutionary upgrades of the high performance tactical surveillance and fire control electro-optical systems by the incorporation of automated target detection, identification, and tracking hardware. In addition to improved weapon effectiveness, these new systems will significantly increase the weapon systems' survivability by reducing their exposure to enemy threats. The needs of the infantry and lightweight air defense systems will be satisfied by the incorporation of low or no maintenance, miniaturized, critical components which will be used in multiple applications throughout the Army. The economies of scale and high emphasis on total integrated logistic support costs reduction will permit an affordable night and adverse weather capability for the infantry. A critical portion of this program is the concurrent development and system integration of electro-optical counter-countermeasures which will prevent the enemy from rendering any of these systems ineffective. This program element contributes directly to major Army technology thrusts in Very Intelligent Surveillance and Target Acquisition (VISTA) and Self contained munitions.

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Program Element: #63710A

Title: Night Vision Advanced Development

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDE					
Funds (current requirements)	33591	33739	29189	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	35617	30224	34816	Continuing	Not Applicable

The reduction in the FY 1982 funding level was due to reprogramming to higher priority Army requirements and the increase in FY 1983 (\$3515), is due to program realignment. The reduction of \$5.627 million in the FY 1984 funding level was due to reprogramming to fund higher priority projects.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This advanced development program bridges the developmental gap between Program Element #62709A, Project #DH95 (Night Vision Investigations) and Program Element #64710A, Project DL70 (Night Vision Devices). Night vision and electro-optical technology and systems for surveillance, target acquisition, navigation, or fire control is a required capability for most of the Defense Department's major weapon systems and is a desired capability for all of them. As a result, a significant number of interagency agreements or understandings on technology and system development have been approved and each year new agreements are approved or active ones are updated. The primary objective of the agreements is the partitioning of responsibilities for materiel development in order to eliminate duplicative efforts. Within the US Army, cooperative agreements exist between the Electronics Research and Development Command and the Tank-Automotive Command (including the program managers for the M1 Abrams and the M2/M3 Bradley Vehicles); the Armament Research and Development Command for Fire Control; the Missile Command for detector technology and missile seeker developments; and the Aviation Research and Development Command for automatic target seekers development for helicopters. In addition to having the executive responsibility for standardizing the use of infrared common modules throughout the Department of Defense (DOD), the Night Vision and Electro-Optics Laboratory is the prime US Army representative to the Joint Technical Coordinating Group for Electro-Optics in DOD. One of the group's prime responsibilities is to insure the elimination of duplicative research and development programs among the three Services. In the interest of achieving maximum standardization and interoperability of these types of systems throughout the NATO alliance, active participation in the Surveillance, Target Acquisition, Night Observation, Panel IV, of the NATO Army Armament Group is maintained. Additional efforts have resulted in the Federal Republic of Germany and the Netherlands adopting a memorandum of understanding for the coproduction and use of the DOD infrared common modules within their weapon systems.

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Program Element: #63710A

Title: Night Vision Advanced Development

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

F. (U) **WORK PERFORMED BY:** The work is performed by the Night Vision and Electro-Optics Laboratory (Fort Belvoir, VA), of the US Army Electronics Research and Development Command, Adelphi, MD. Primary contractors include: Rockwell International, Anaheim, CA; Hughes Aircraft Company, EL Segundo, CA; Texas Instruments, Inc., Dallas, TX; Honeywell Inc., Lexington, MA, and Minneapolis, MN; Magnavox Corp., Mahwah, NJ; Martin Marietta Co., Orlando, FL; Northrop Corp, Anaheim, CA; Aeronautronic Ford Corp, Newport Beach, CA.

G. (U) **PROJECTS LESS THAN \$10 MILLION IN FY 1984:**

1. (U) **DK86 — Night Vision for Airborne Vehicles:** The purpose of this project is to identify and exploit new technologies as they apply to solving critical night vision or electro-optical deficiencies for US Army airborne vehicles. The unique operational requirements and system capabilities for these vehicles (as well as those for the combat vehicles discussed below under Project DK87) demand system integration techniques which are uncommon to other battlefield target acquisition and fire control subsystems. Major accomplishments during FY 1982 were the successful flight tests of a miniaturized and stabilized infrared sensor package on fixed- and rotary-wing aircraft for demonstrating the capability of infrared surveillance and fire control for small unmanned airborne vehicles and the initiation of the effort to integrate a high-performance infrared sensor onto a UH-1 vehicle to serve as a data collection device permitting the establishment of air-to-ground image data base on which future automatic target classifiers will operate. During FY 1983, this Airborne Sensor System for Evaluation and Test (ASSET) will complete its aircraft integration, will have the digital scan converter (developed under project DK70) integrated into it, and will begin to establish the digital data base for automatic target classifier systems. The data collection will continue into FY 1984 when final flight tests will indicate which class of target recognizers will be standardized for Army airborne use. The adopted standard will be full-scale development under respective project managers for aviation weapon system programs, but will be configuration managed by the Night Vision and Electro-Optics Laboratory as a standard infrared system, common module, after the weapon system's type classification.

2. (U) **DK87 — Night Vision for Combat Vehicles:** As with project DK86, this project addresses the unique US Army requirements for multisensor electro-optics technologies for combat vehicles, the mechanized infantry, and other ground maneuver elements. Most combat vehicles require the integration of more than one electro-optical sensor. The combination of a gunner target acquisition system, a laser rangefinder system, and potential use of a commander's and driver's viewer devices demands a total system integration concept which will maximize the synergistic effect of multisensors. During FY 1982, models of the Advanced Driver's Viewer were completed and the initial developmental testing conducted. Operational testing began and will continue to late FY 1983 when full-scale, engineering development will begin under program element 64710A. Similarly, the CO2 Laser Rangefinder successfully completed advanced development and will become a vital part of the M1 Abrams Tank Product Improvement Program. The Independent Commander's Viewer Program will continue in Advanced Development until FY 1984. A very significant accomplishment was the demonstration of the advantage of a pole elevated sensor on the battlefield for target acquisition and artillery adjustment. The HELBAT 8 tests conducted at Fort Sill, OK indicated the capability of completely passive (nonradar) sensors to accurately detect and recognize targets to five

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DOD Mission Area: #551 — Electronic and Physical
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Budget Activity: #2 — Advanced Technology Development

kilometers while keeping the vehicles and crew in defilade. As a result of this success, the Elevated Target Acquisition System (ETAS) will begin advanced development in FY 1983 with a multisensor concept employing an infrared system, a laser rangefinder, a high resolution TV, a radio frequency interferometer (for enemy radar detection), and an option for a low-power, survivable, low-probability-of-intercept (LPI), modular radar system. This development will continue into FY 1984 with development test scheduled for early FY 1985. The ETAS pole (50 to 80 feet) will be designed to be integrated also onto the Light Armored Vehicle (LAV) when selected by the US Army for its light divisions and onto an M2/M3 Bradley Fighting Vehicle chassis for the conventional heavy close combat vehicles.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: DK70 — Night Vision Advanced Development

a. (U) Project Description: The Army has the need for a cost-effective ability to fight at night and during limited visibility as effectively as during the day. This project applies new techniques, components, and devices to produce significant cost reductions and performance improvements for night vision devices to meet that need. The combat capability is required to counter the threat of a foe that plans to continue combat operations during periods of darkness and limited visibility. This is the base project for this program element and has as its objective the advanced development of night vision components and devices which have applications that are not unique to a specific weapon system or vehicle. The key areas of investigation include infrared focal plane detecting arrays and focal plane system prototypes or demonstrators, automation hardware and software advanced development for all electro-optical systems, and multi-sensor system integration using critical technologies such as low power multifunction lasers and millimeter wave target detection and classification devices.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: The Thermal Weapon Sight (TWS) development program continued on schedule and within budget with final hardware scheduled for developmental testing in the third quarter of FY 1983. The Passive Wide Area Alerting system and the Ground to Air Infrared System Target Classifier providing for passive, noncooperative Identification Friend or Foe (IFF), were delayed while awaiting the analysis of the limited ground-to-air imagery data base by the US Navy. The alerting system contract was solicited during the last quarter of FY 1982; the IFF system will be solicited in FY 1983. The delays will not impact upon the US Army's goals provided FY 1983 awards of these programs are made. The upgrade of the Prototype Automatic Target Screener (PATs) and the field testing of the Automatic Target Cues (ATC) began. Contract Award of the firing demonstration program for the prototype Multi-Sensor Target Acquisition System (MTAS), formerly called STARTLE, was made following successful evaluation of the two multisensor system candidates. The selection of the winner of the digital scan converter common module development was made and the program for the modules productization and configuration baseline control was awarded. Using a new high-yield liquid phase

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Program Element: #63710A

Title: Night Vision Advanced Development

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

epitaxial growth process, the first 60 element common module detector arrays were fabricated with performance exceeding the current specifications. The stabilization techniques program was initiated and full operation of a dynamic testbed for focal plane evaluation will be available in FY 1983. The major contracts for the development, integration, and test of electro-optical counter-countermeasure (CCM) componentry for existing systems continued; additional efforts began concurrently with the TWS program in this project and the ETAS program in project DK87 to ensure that Counter Countermeasure (CCT) protection is afforded these new systems prior to their transition to engineering development. A contract for a second source CO2 Laser Rangefinder for the M1 Abrams Tank Fire Control System Product Improvement Program has been awarded. A development program for the Miniature Eyesafe Laser Infrared Observation Set (MELIOS) for use by the infantry for rangefinding in battlefield scenarios where eye safety is critical will be initiated.

(2) (U) FY 1983 Program: The TWS program will complete development testing and begin operational testing this fiscal year. Hardware representing two different design concepts has been procured and the better of the two will be the recommended concept within the competitively solicited engineering development (ED) program scheduled for FY 1984. The Passive Wide Area Alerting System program will begin during the first quarter FY 1983; the IFF system will be solicited during the second quarter of the fiscal year. The PATS system and the digital scan converter common modules will be tested in the UH-1 testbed, the ASSET system described in project DK86, and flight tested prior to its delivery to the US Army's Aviation Research and Development Command for integration into the AH-64 Attack Helicopter. The multisensor sensor using infrared and millimeter wave devices will be integrated into the High Mobility and Agility (HIMAG) test vehicle in cooperation with the US Army Tank Automotive Command, and demonstrate the automatic capability of multiple target detection, classification, and fire control aim point selection using a rapid-fire 75-millimeter cannon and munitions provided by the Armament Research and Development Command. The common module detector arrays fabricated using the liquid phase epitaxial (LPE) process will be evaluated for a production transition decision. The LPE growth process will be modified to include detector array processing for the high density second generation focal planes used in the TWS program. These focal planes will also be evaluated by the stabilization facility to support the missile seeker activity of the US Army Missile Command. The electro-optical CCM program will continue. The qualification of the second source for the M1 Tank Laser Rangefinder will occur and the program will be transitioned to engineering development under the main battle tank program. The development of Miniature Eyesafe Laser Infrared Observation Set will continue; a compact laser for use by special forces will also be demonstrated.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Operational tests will complete the TWS advanced development program. The TWS will be evaluated against the Nite Infantry Thermal Equipment (NITE) requirements and the Stinger Air Defense Missile System night sight requirement. In keeping with the basic philosophy of acquisition and logistic-support commonality for the sights and their components, TWS advanced development will continue, but during FY 1984, will be addressing the requirements of a night sight and tracker for the Army's RATTLER program and a stabilized sight as a seeker candidate for the Fiber Optically Guided Missile. A memorandum of understanding has been

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Program Element: #63710A

Title: Night Vision Advanced Development

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

recently signed by the Commanders of the Army's Electronic Research and Development Command and the Missile Command to insure that maximum consideration will be given to identify the least expensive approach to the seeker's development. Development Test and Operational Test (DT/OT I) are scheduled to begin on the Passive Wide Area Alerting System by the end of FY 1984. Since this system is the passive adjunct to the Electronic Support Measures Program ADEWS (Air Defense Electronic Warfare System), the passive system will be integrated onto the same vehicle as ADEWS and undergo a joint DT/OT I. Both systems will represent an integrated version of the air defense search, detecting, and tracking system for the Short Range Air Defense Command and Control (SHORAD C²) program. Engineering development will begin in FY 1985. The passive IFF system will continue advanced development until successful completion of its DT/OT I in mid-FY 1985. An advanced development model of the Automatic Target Cues (ATC) will be integrated into the ETAS vehicle (being developed under project DK87) and provide the field artillery the capability to rapidly (automatically) detect and classify targets with a completely passive system. Following the successful multisensor fire demonstration on the HIMAG vehicle during the last quarter FY 1983, the advanced development of the Multi-Sensor Target Acquisition (MTAS) for the M1 Abrams Tank and the M2/M3 Bradley Fighting Vehicle will begin. The electro-optical CCM developments will concentrate on the Multi-Sensor Target Acquisition System (MTAS) and Elevated Target Acquisition System (ETAS) programs; its results for the TWS will be transferred with the basic sight program into engineering development. The LPE focal plane technology for the TWS will also be transferred during FY 1984, while the second-generation focal plane arrays will be integrated into the first of the prototype advanced infrared imaging systems. As part of a multisensor fire control system, the three-dimensional CO2 laser radar device for all-visibility target acquisition and engagement will be hardened. During FY 1984, the Miniature Eyesafe Laser Infrared Observation Set program will complete advanced development and will be transferred to engineering development.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63725A

Title: Remotely Piloted Vehicles (RPVs)/Drones

DOD Mission Area: #551 -- Electronic and Physical Sciences (ATD)

Budget Activity: #2 -- Advanced Technical Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1303	4155	6359	6572	Continuing	Not Applicable
Dk61	Remotely Piloted Vehicles/Drones	1303	4155	6359	6572	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides an Advanced Development base for improvements to the Remotely Piloted Vehicle (RPV) System being developed under Program Element (PE) 64730A and for the development and demonstration of additional RPV mission capabilities. RPVs are required to extend the eyes of the brigade and division commanders to the range of their artillery, increase the effectiveness of their direct support firepower, and provide laser designation for laser-guided weapons. Sophisticated enemy air defense systems preclude the use of manned aircraft performing such penetration missions. Projected improvements to the RPV system include night/adverse weather sensors utilizing Forward Looking Infrared (FLIR) and millimeter radar technology, improved command and control techniques such as multiple air vehicle control from a single ground station and extended range of operation, survivability simulations and studies, eye-safe laser, and air traffic control/identification friend or foe. Additional missions identified in the Required Operational Capability (ROC) for the Remotely Piloted Vehicle include electronic warfare, meteorological sensor, communication relay platform, radac survey, and decoy operations.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	1303	4155	6359	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	4508	4188	6800	Continuing	Not Applicable

FY 1982 funds were reprogrammed to RPV PE# 64730A to reduce the risk in achieving the RPV full-scale development schedule. The funding decrease of \$11 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE,A appropriation. The \$241 thousand funding decrease in FY 1984 resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #63725A

Title: Remotely Piloted Vehicles (RPVs)/Drones

DOD Mission Area: #51 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technical Development

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Within the Army, Exploratory Development of RPV technology was conducted under Program Element (PE) #62732A (RPV Supporting Technology). Full-scale development (FSD) of the first-generation RPV is conducted under PE #64730A (Remotely Piloted Vehicles). This program element (63725A) provides an Advanced Development base for moving Supporting Technology programs into Engineering Development. The Army, Air Force, and the Navy RPV Program Managers and Marine Corps liaison officer meet to preclude duplication of efforts among the Services. Interoperability is being pursued through a Memorandum of Understanding with the United Kingdom. There is no duplication of effort in mini-RPVs within the Services.

F. (U) WORK PERFORMED BY: US Army Aviation Research and Development Command, St. Louis, MO; Combat Surveillance and Target Acquisition Laboratory, US Army Electronics Research and Development Command, Fort Monmouth, NJ; Research and Technology Laboratories, Aero Mechanics Laboratory, Moffett Field, CA; Applied Technology Laboratory, Fort Eustis, VA; and the US Army Night Vision and Electro-Optics Laboratory, Fort Belvoir, VA. Contractors actively participating in the RPV development are Lockheed Missiles and Space Company, Inc., Sunnyvale, CA; Honeywell, Lexington, MA; Harris Corporation, Melbourne, FL; Georgia Institute of Technology, Atlanta, GA; and Hughes Aircraft, Culver City, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: DK61 — Remotely Piloted Vehicles/Drones: The objective of this project is to develop and test improvements which enhance the capability of the Aquila System to fully meet the operational and technical capabilities identified in the ROC as required/desired growth options for the RPV. Efforts are oriented at providing this system with improved night/adverse weather sensors and improved command and control capabilities that permit multiple air vehicle operations from a single ground control station as well as operations at greater ranges. Provisions to accommodate other mission capabilities for mini-RPVs are being pursued to provide a broad range of capabilities for use beyond the Forward Line of Troops (FLOT). This program provides an advanced development base for improvements to the RPV. Commonality of components within the Army programs and with other Service programs is being pursued. The main effort in FY 1982 was the development and testing of an RPV Mission Payload Subsystem (MPS) with night and limited adverse weather capability. The Forward Looking Infrared (FLIR) MPS will be alternate and interchangeable with the daylight MPS and will perform the same functions of target detection, recognition, fire adjustment, and damage assessment for the field artillery as well as laser designation for the US family of Precision Guided Munitions (PGM). This program addresses a long-stated need for 24-hour operation of the RPV System and is a requirement in the RPV ROC. Tests and measurements analyses and simultaneous studies will be conducted to address an Army requirement to define the effectiveness of FLIR and day mission payloads at high designation and sensor look angles in clear air and smoke obscurant environments to define target reflectivity characteristics. In FY 1982 the FLIR Mission Payload System (FMPS) was delivered to the Government for test and evaluation in a manned aircraft. FMPS performance was evaluated both day and night under simulated tactical conditions. FMPS imagery of operational tank and truck targets was assessed as meeting and/or exceeding detection/

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Program Element: #63725A

Title: Remotely Piloted Vehicles (RPVs)/Drones

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technical Development

recognition requirements. In FY 1983 FLIR mission payload development efforts will be completed, and the program will progress to full-scale development in early FY 1984. In FY 1984 a competitive hardware contract will be awarded to develop the capability of simultaneously controlling several air vehicles from one ground control station. This capability will allow full utilization of RPV equipment and personnel to achieve maximum coverage for the field artillery, while at the same time, providing the capability to support other missions for the Intelligence and Electronic Warfare (EW) Community. Other tasks include survivability enhancements to improve air vehicle survivability and advanced applications to provide analysis, design, fabrication, and modifications as required for other Army RPV missions; e.g., electronic warfare, radio relay, meteorological data gathering, radiac survey, ground sensor and beacon delivery, mine detection and intelligence missions.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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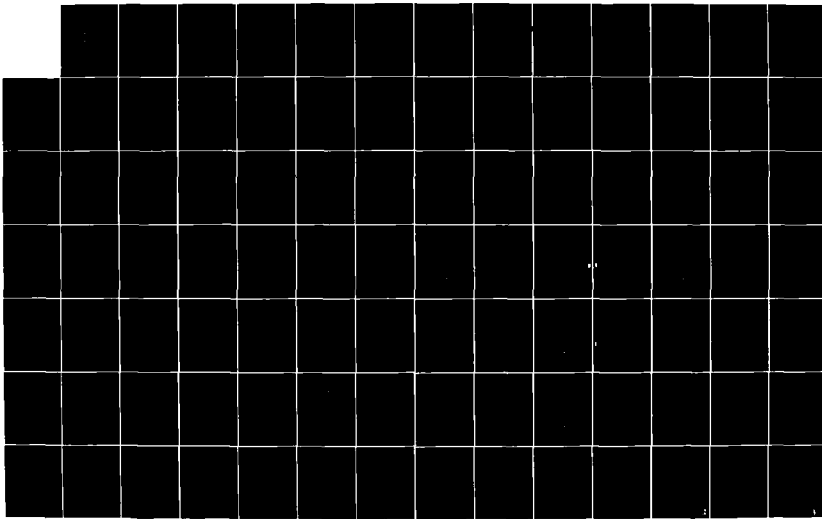
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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63731A

Title: Manpower and Personnel

DOD Mission Area: #552 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	4159	7479	12021	14457	Continuing	Not Applicable
A792	Manpower and Personnel	4159	7479	12021	14457	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Manning the force with the required quantities and quality of personnel remains one of the Army's most critical needs. Methods must be developed to improve the selection and utilization of soldiers and to determine the manpower demand of new systems upon the available manpower supply. Requirements must be anticipated early in the system acquisition process to permit effective planning for personnel acquisition and training. This requires analysis of human performance requirements of new systems and procedures for trading off system design consideration for human performance requirements. This program element, as part of the major Army technology thrust in Soldier-Machine Interface, provides for research to develop models for projecting personnel resources and for allocating resources to requirements; techniques for attracting needed personnel into the Army and assigning them to Military Occupational Specialties that capitalize on their aptitudes and interests; programs for retaining highly qualified personnel; and programs for developing cohesive units and the leaders needed to assure effective combat readiness in the high-technology Army environment. This program element provides the Army's response to the Congressional requirement for a DOD-wide effort to relate selection criteria to successful on-the-job operational performance.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	4159	7479	12021	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	4103	9747	12077	Continuing	Not Applicable

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Program Element: #63731A

Title: Manpower and Personnel

DOD Mission Area: #562 — Environmental and Life
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

The increase of \$56 thousand in FY 1982 funding level is a result of reprogramming from lower priority Army requirements. The funding decrease of \$2268 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act. The decrease of \$56 thousand in the FY 1984 funding level is a result of a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This work is coordinated with Naval Personnel Support Technology, Program Element #62763N; Navy Manpower Control System Development, #63707N; Air Force Personnel Utilization Technology, #62703F. Technology input is provided by the related Army Program Element #62722A (Manpower, Personnel, and Training). Tri-Service technical advisory groups in education and training, manpower, personnel, and organizational effectiveness coordinate Service developments to eliminate unnecessary overlap of effort. Cooperative research efforts with the Navy and Air Force are conducted in areas of personnel selection and the Armed Services Vocational Aptitude Battery.

F. (U) WORK PERFORMED BY: Primary contractors are: WESTAT, Inc., Rockville, MD; Planning Systems, Inc., McLean, VA; Human Resources Organization, Alexandria, VA; Dynamics Research Corp., Wilmington, MA; and Anacapa Sciences, Inc. There are 15 additional contractors; the total value of the additional contracts is \$2,158,375. The Army developing agency responsible for this program is the US Army Research Institute (ARI) and its field activities which are collocated with Army operational commands.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: A792 — Manpower and Personnel:

a. (U) Project Description: Research is intended to improve the Army's ability to identify personnel requirements early in weapon systems development and to relate the available manpower pool to these requirements in order to maintain high levels of combat readiness in the face of the largest modernization program the Army has ever undertaken. This project will: (1) develop and evaluate a system that integrates manpower, personnel, and training considerations throughout weapon systems development; (2) provide job aids and management tools for the Army to use in the efficient management of the recruiting force; (3) validate the new Armed Services Vocational Aptitude Battery; (4) provide techniques to reduce attrition and increase reenlistment of highly qualified soldiers; and (5) assist programs for implementing a unit rotation manning system and for assimilating replacement soldiers into units.

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Program Element: #63731A

Title: Manpower and Personnel

DOD Mission Area: #552 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Measures of job performance were tested and established as criteria for validating the Armed Services Vocational Aptitude Battery (ASVAB); the reliability of ASVAB scoring was affirmed; a preenlistment screening test for Army applicants was developed and evaluated. Training measures were merged and matched with the FY 1981 Active Army Accession tape for over 32,000 individuals' records for use in validating ASVAB scores as predictors of school and on-the-job performance. The Flight Aptitude Selection Test was revised and fielded, for selecting Army flight school trainees. A performance-based assessment system for selecting officer trainees was developed and field tested, and four training modules to improve officer training were developed. Survey techniques were devised to aid in retention of the most highly qualified officers. A highly useful Commander's Unit Analysis Profile (CUAP), for providing diagnostic information to company commanders, was completed. The feasibility of Army use of the Navy's HARDMAN system to determine the implications of weapon systems concepts and developments on manpower requirements was successfully demonstrated. A computer-based Training Developer Decision Aid for assisting air defense training program developers was completed. An organizational analysis and improved management methodology was successfully demonstrated in an element of the World-Wide Military Command and Control System, and a handbook for wider application of the method was completed. A preliminary evaluation was completed of the impact of the Army's Organizational Effectiveness (OE) program.

(2) (U) FY 1983 Program: An econometric reenlistment model using operations research techniques will be completed, as will a model for allocating training resources. Prototype measures for use as post-enlistment predictors and prototype non-job-specific measures for predicting success in the Army will be provided. MOS-specific performance measures for a pilot group of MOS will be developed. The Revised Flight Aptitude Selection Test (FAST) will be validated, and procedures will be developed to optimize the selection of aviation warrant officers. Testing of student aviators on the mission track assignment battery will be completed. Remedial training modules for 12 leadership dimensions identified in earlier research will be completed, and a paper-and-pencil test will be cross-validated with other criteria. An analysis of the effects of gender and tradition on retention and an analysis of the relationships between retention and soldier expectation will be accomplished. Recommendations will be provided for unit management of first-term enlistee attrition based on research of soldier attrition in Europe as compared to that in the US. Attrition as a function of school success will be analyzed, and the Army Education Information System relationship to retention validated. MOS-specific performance measures will be developed for selected MOSs. Strength/stamina tests as predictors of performance on Army jobs will be evaluated. A handbook for applying front-end analysis techniques for Systems Acquisition Reports will be completed. The Navy's HARDMAN methodology for determining manpower implication of new weapons systems while in the design and development phase will be applied to two Army systems (155mm Self-propelled Howitzer Improvement and Corps Support Weapon System), and a handbook detailing how to use HARDMAN for Army applications will be developed. The Training Developer Decisions Aid will be provided to Army schools, and tests of an interactive version of the model will be completed. Assessment of the effects of a new Program of Instruction for the unit rotation manning system will be completed, and recommendations for the Army Personnel Management System operating under a unit rotation policy will be developed. Preliminary identification of elements for a leader-development program

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Program Element: #63731A

Title: Manpower and Personnel

DOD Mission Area: #552 — Environmental and Life
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

evaluation system will be completed. An Organizational Effectiveness information system prototype will be provided, and a new procedure for modifying social systems (working groups) to fit the requirements of technical systems will be evaluated. Finally, measures for assigning officers to specific specialties based on predictors of performance effectiveness will be assessed for use in the Officer Personnel Management System.

(3) (U) FY 1984 Planned Program and Goals for Budget Year Request: The FY 1984 program is designed to continue a multiyear effort to validate the new Armed Services Vocational Aptitude Battery (ASVAB), and will provide field tests of new and/or improved measures of the predictors of Army success. Job knowledge tests will be developed for ASVAB validation criteria and as predictors of on-the-job performance and successful adaptation to the Army. An alternative form of the Flight Aptitude Selection Test will be completed. Officer selection test material will be evaluated for performance appraisal validity and equal employment opportunity fairness. Quantitative models of reenlistment policy impact will be completed. The Aviation Warrant Officer and Commissioned Officer Separation Form developed in FY 1983 will be field tested. A prototype method for relating personnel requirements to system design early in the acquisition process will be completed providing methods for task analysis, task allocation/trade-offs, establishment of training requirements, and establishment of manpower planning and forecasting procedures. Complete procedures for applying the HARDMAN methodology to Army systems will be thoroughly documented. The impact of the various types of Organizational Effectiveness (OE) programs in the Army will be assessed using the OE Management Information System. Initial guidelines for the sociotechnical design of new weapons systems will be prepared.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63734A

Title: Combat Engineering Systems

DOD Mission Area: #553 — Engineering Technology (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	269	1726	2050	1296	Continuing	Not Applicable
DTC9	Military Construction and Field Engineering	269	255	249	251	Continuing	Not Applicable
DT09	Energy Systems Tests	- 0 -	1471	1801	1045	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Project DT08 — provides for the validation and technology transfer, in a prototype environment, of methods and techniques developed in exploratory development programs to provide weapon effects information and combat engineering support on the battlefield. One of the mission area shortfalls is the impact of debris clouds created by exploding ordnance on electro-optical sensor systems used for target acquisition and weapon system guidance. Work in this program will address the characterization and measurement of the debris cloud environment and the demonstration of innovative concepts and techniques for improving mobility in difficult terrains. Project DT09 — addresses energy consumption and availability in the Base Facility Development and Installation Support Activities in the Army Base Support Mission Area. This program is essential to support the planning, design, construction, operation, and maintenance of Army facilities worldwide. The thrust of this program is to demonstrate on Army installations the effectiveness of technologies evaluated in exploratory research. The technologies to be tested have potential for increasing the energy efficiency of new and existing Army facilities, or to permit utilizing alternate energy sources. The objectives are to provide the Army with proven technology to reduce energy costs, increase the energy independence of Army facilities, and improve the management of energy resources.

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Program Element: #63734A

Title: Combat Engineering Systems

DOD Mission Area: #663 — Engineering Technology (ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	269	1726	2060	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	269	2730	2127	Continuing	Not Applicable

The decrease of \$1004 thousand in FY 1983 is the result of Congressional direction in the FY 1983 Appropriations Act. The decrease of \$77 thousand in FY 1984 is a result of reprogramming to higher priority programs and revision of anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Project #T06 (Military Construction and Field Engineering) — This program element will apply the exploratory development performed under Program Element #62719A (Mobility & Weapons Effects Technology), Project #AT40. Additionally, this work will be coordinated with the activities of the other Services in the Tri-Service Plan for Atmospheric Transmission Research and Development. The lead laboratory for the Army Atmospheric Transmission Research and Development Program is the Atmospheric Sciences Laboratory; the lead laboratories for the Navy and Air Force in this area are the Naval Research Laboratory and Air Force Geophysics Laboratory. DT09 — This project is coordinated on an inter-Service basis with the Navy, Air Force, and Marine Corps through the activities of the Joint Services Civil Engineering Research and Development Coordinating Group, and with other Government agencies through workshops. Joint programs with the Air Force include the Energy Audit Program and technology transfer of the Building Loads Analysis and Systems Thermodynamics (BLAST) Program. Related programs include: Program Element #61102A (Defense Research Science), Project #AT23 (Basic Research in Military Construction), US Army Construction Engineering Research Laboratory, Champaign, IL; Program Element #62731A (Military Facilities Engineering Technology), Project #AT41 (Military Facilities Engineering Technology), US Army Construction Engineering Research Laboratory, Champaign, IL; and Program Element #62781A (Energy Technology Applied to Military Facilities), Project #AT46 (Energy Technology Applied to Military Facilities), US Army Construction Engineering Research Laboratory, Champaign, IL. In cooperation with the Department of Energy, the US Army has been assigned lead responsibility for coordinating DOD energy activities in solar heating and cooling, computer programs to determine energy characteristics of buildings, wood-fired boilers, energy storage and distribution, energy conservation, and advanced heating and air conditioning systems.

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Program Element: #63734A

Title: Combat Engineering Systems

DOD Mission Area: #553 — Engineering Technology
(ATD)

Budget Activity: #2 — Advanced Technology Development

F. (U) WORK PERFORMED BY: DT08 — The US Army Engineer Waterways Experiment Station, Vicksburg, MS, performs 50% of the work in-house. Another 30% of the in-house work is performed by the Atmospheric Sciences Laboratory, White Sands Missile Range, NM. The remaining 20% of the work is performed by contractors selected in accordance with Defense Acquisition Regulation procedures. DT09 — Approximately 30% of project funds will be for in-house effort participation by the US Army Facilities Engineering Support Agency, Fort Belvoir, VA. The remaining 70% is to be performed by contractors selected in accordance with Defense Acquisition Regulation procedures.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) DT08 — Military Construction and Field Engineering: The objective is to verify and demonstrate the validity of techniques, methods, and criteria developed in technology base programs for weapons effects, combat engineering, and theater of operations construction activities. These techniques, methods, and criteria will be rapidly transferred to appropriate field Army units to improve their survivability and operational capability on the battlefield. This was a new project in FY 1982, and accomplishments include selection of a test site and completion of a test plan for a joint demonstration test with the Atmospheric Sciences Laboratory to verify munitions debris cloud simulation techniques under obscured battlefield conditions, and development of plastic grid specifications for constructing a sand-grid road to demonstrate the adequacy of sand-grid confining systems for improving over-the-beach mobility. FY 1983 milestones are to conduct the demonstration test to verify munitions debris cloud simulation techniques, and to complete grid procurement and develop and coordinate demonstration plans with Army engineer units of the sand-grid confining system for enhancing over-the-beach mobility. FY 1984 goals are to analyze the results of the munitions debris cloud demonstration test and upgrade debris cloud simulation procedures, and to conduct the demonstration test of a sand-grid confining system using engineer troops and equipment.

2. (U) DT09 — Energy Systems Tests: This project is for the USA Construction Engineering Research Laboratory to carry out demonstrations and tests of new energy systems technology at Army installations. The project focus is to demonstrate technology developed through exploratory research for effective energy conservation, alternate energy sources, and management of energy resources on Army installations. This is a new project in FY 1983. Goals for FY 1983 include: (1) evaluate high-efficiency furnaces for family housing at Fort Hamilton, NY; (2) evaluate water source heat pumps for small-scale heating systems at Fort Hamilton, NY; and (3) evaluate energy use after implementation of installation-wide energy management and conservation methods at Fort McClellan, AL. Goals for FY 1984 include demonstration of a low-energy use battalion headquarters building at an Army installation and retrofit improvements of heating, ventilating, and air conditioning controls to reduce energy consumption in existing Army buildings. Work will continue on the demonstrations at Forts Hamilton, NY, and McClellan, AL.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63737A

Title: Antiradiation Missile Countermeasures (ARM-CM)

DOD Mission Area: #551 — Electronic and Physical
Sciences (Advanced Technology
Demonstrations)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	4611	5493			Continuing	Not Applicable
D181	Antiradiation Missile Countermeasures	4611	5493			Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Historical experience in the 1973 Mideast war shows that US . This program element provides the broad, nonsystem-specific technology base for the development of countermeasures to the antiradiation missile threat. The program is oriented at developing countermeasures applicable to. The effort addresses five areas of activity: threat evaluation and simulation; countermeasures development; laboratory simulation and testing; establishment and maintenance of a tri-Service field test capability; and support of the Tri-Service Joint Working Group on Antiradiation Missile Countermeasures (ARM-CM). This program provides continuing analysis of threat information to provide up-to-date simulations of enemy systems for the evaluation of ARM-CM effectiveness; update capabilities of generic seeker to emulate enemy systems and initiate reconfiguration and new construction of a generic seeker to include postulated ARM seeker design responses to present and planned ARM-CMs; provide field test instrumentation, field test support, and data reduction for planned field tests of advanced development models of ARM-CMs for Air Force, Marine Corps, Patriot, DIVAD, and other radars; continue development and test of; continue development of postulated continuous wave (CW) ARM systems and development of countermeasures applicable to CW systems; continue analysis of anti-ARM radar technique for application to future radar system design; continue development of mainbeam ARM definition and countermeasures; continue analysis and development of active ARM-CM techniques; provide support to the Tri-Service ARM-CM Working Group and NATO ARM-CM analysis.

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Program Element: #63737A

Title: Antiradiation Missile Countermeasures (ARM-CM)

DOD Mission Area: #551 — Electronic and Physical
Sciences (Advanced Technology
Demonstrations)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	4611	5493		Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5305	5508		Continuing	Not Applicable

Decrease in FY 1982 resulted from reprogramming to higher priority programs. The funding decrease of \$15 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE,A appropriation. Funding difference in FY 1984 is attributable to program realignment and revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Development of antiradiation missile countermeasures is conducted by the three Services with the Army as the lead Service. The threat data and simulations, countermeasure technology, and field test instrumentation developed within this program are utilized within the specific ARM-CM development activities done in Program Elements #64307A (PATRIOT), #23731A (Improved Hawk), and #63729A (Counterbattery Radar). The Navy has conducted work in Program Element #63516N (Radar Surveillance Equipment), and the Air Force in #63918F (Electronic Warfare Technology) and #63750F (Counter-Countermeasures Advanced Development). The field test instrumentation and computer simulations developed under this project directly support the Navy and the Air Force work. The three Services routinely coordinate their respective programs via the Tri-Service Joint Working Group on ARM-CM, tri-Service meetings with the intelligence community to define critical gaps in knowledge, and through symposia with the developers.

F. (U) WORK PERFORMED BY: The present contractors utilized in accomplishing this program are TRIAD Microsystems, Inc., Huntsville, AL; General Dynamics, Pomona, CA; Brunswick Corporation, Defense Division, Costa Mesa, CA; CAS, Huntsville, AL; Malibu Research Associates, Inc., Santa Monica, CA; Technology Services Corporation, Santa Monica, CA, and Silver Spring, MD; General Electric Corp., and Syracuse Research Corp., Syracuse, NY; and ESL Inc., Sunnyvale, CA. The in-house developing organizations responsible for executing the program are Harry Diamond Laboratories, US Army Electronic Research and Development Command (ERADCOM), Adelphi, MD; US Army Missile Command (MICOM), Redstone Arsenal.

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Program Element: #63737A

Title: Antiradiation Missile Countermeasures (ARM-CM)

DOD Mission Area: #551 — Electronic and Physical
Sciences (Advanced Technology
Demonstrations)

Budget Activity: #2 — Advanced Technology Development

AL, Naval Weapons Center (NWC), China Lake, CA; US Air Force Rome Air Development Center, Rome, NY; Defense Communications Agency (Defense Engineering Center), Reston, VA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D181 — Antiradiation Missile Countermeasures: The Army has fielded and has under development a variety of. These systems are relatively complex and expensive, and serve a critical role for the Army in the field. All are susceptible to enemy antiradiation missile attack in varying degrees. Given their criticality and susceptibility, it is imperative that ARM countermeasures be developed and tested vis-a-vis the known and projected threat. The objectives of this program are to characterize and simulate the known, responsive (to US emitter and ARM-CM designs), and projected threat missile systems, to develop appropriate countermeasures to provide laboratory and field test instrumentation, and to provide tri-Service data exchanges. The FY 1982 analysis of anti-ARM radar design techniques for future radars is in the third year of a three-year contract. Two reports have been completed by General Electric, Syracuse, NY. The first report shows that the mission requirements make most Army aircraft. The second report shows how. Analysis of continuous wave (CW) ARM homing methods and CW countermeasure techniques against CW ARMs was completed. Feasibility analysis of the main beam and binning ARM has continued, and analysis of field test data on the adaptive intensity discriminant was completed. Support in ARM-CM analysis to NATO and the Tri-Service ARM-CM Working Group was provided. Many existing computer simulation programs that evaluate the effectiveness of a specific ARM against a specific radar have been modified and transformed into modular components so that a newly written program may select any ARM, and radar, and any ARM countermeasure for an effectiveness evaluation. At the same time, the computer programs were made more transportable to other computers. In FY 1983 threat ARM simulation will continue. The ARM-CM program's instrumented aircraft will support Navy ARM-CM tests in November and December 1982, the Air Force TPS-43E tests from December 1982 to January 1983, and the Marine Corps TPS-59 tests in the spring or summer of 1983. The development of a lightweight magnetron for the modular decoy (MODEC) will be completed and tested in FY 1983. The PATRIOT program will use the technology developed under this program to begin development of an engineering design model. Analysis of anti-ARM radar techniques for future radar design will be completed. The analysis will focus on how radars should be integrated into the future battlefield. Analysis of the main beam, angle binning, and navigating ARM seeker technology, as well as possible countermeasures against these projected threats, will continue. Analysis of active (i.e., hard kill) ARM-CM techniques will continue, and an analysis of the feasibility of an anti-ARM missile system will begin. Modest efforts will be initiated at defining the loitering-drone/remotely piloted vehicle (RPV) threat. Continuous wave (CW) countermeasures development will be initiated as well as countermeasures development for the projected threats of main beam ARM. The design of an advanced generic seeker and support instrumentation as a testbed to closely emulate present and projected threats will be completed. The performance of chaff (used as an ARM-CM) will be evaluated. The fabrication of a completely passive decoy form for full-scale testing will begin. New initiatives will include a design trade-off study of a main-beam ARM decoy antenna, which would be supplied radio frequency (RF) power from sidelobe-covering, active decoys being developed by project managers. Low cost, survivability, portability, and effectiveness are key design goals. The major new effort in FY 1984 will be to complete the design of an advanced generic seeker instrumentation system and begin its fabrication. Other efforts will include possible quick look response efforts

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Program Element: #63737A

Title: Antiradiation Missile Countermeasures (M-CM)

DOD Mission Area: #551 — Electronic and Physical
Sciences (Advanced Technology
Demonstrations)

Budget Activity: #2 — Advanced Technology Development

to demonstrate the effectiveness of the main beam ARM, both analytically and perhaps with hardware in a field test. Blast testing of a passive decoy panel and fabrication of a passive decoy illuminator, which uses a magnetron-type active decoy, will begin. This illuminator will contain a ramp generator to prevent both ARM attack on the illuminator and accurate location by threat time-of-arrival systems. Many advances in the other phases of the program are expected, but the direction and priorities of these efforts will be strongly influenced by the coordination with the project managers as they review the progress of this program in FY 1983. Test support for new ARM-CM techniques will be provided. The passive decoy brassboard hardware will be developed and evaluated. Support for NATO and the Tri-Service ARM-CM Working Group will be continued.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63739A

Title: Human Factors in Training and Operational Effectiveness

DOD Mission Area: #552 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	3225	3745	8277	7524	Continuing	Not Applicable
A793	Human Factors in Training and Operational Effectiveness	3225	3745	8277	7524	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Force modernization will be one of the Army's critical objectives over the next decade. The Army has over 200 new systems, including 40 major systems, programmed for acquisition in the next 10 years. The soldier, as an integral part of weapon systems, must be designed into the system early in development. This program element, as part of the Army's major technology thrust in Soldier-Machine Interface, will develop new methods to ensure that systems are designed to be compatible with soldier capabilities. Techniques to measure total system effectiveness, including the human operator, must be tailored to the specific operational use for which the system is intended. Shortcomings in designing equipment to match human capabilities will require the additional development of performance aids in order for the system to achieve full performance capacity. This program is also concerned with operator performance in automated command and control systems that will become increasingly important on the battlefield of the future. The complex decisionmaking skills required by complex systems for both operation and maintenance require that research be conducted to determine how the cognitive skills of soldiers can best be improved.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	3225	3745	8277	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	3111	3755	6486	Continuing	Not Applicable

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Program Element: #63739A

Title: Human Factors in Training and Operational Effectiveness

DOD Mission Area: #552 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

Increase of \$114 thousand in the FY 1982 funding level is a result of reprogramming to higher priority Army requirements. The funding decrease of \$10 thousand in FY 1983 is the result of a pro rata application of general Congressional reductions to the RDTEA appropriation. The funding increase of \$1781 thousand in FY 1984 is a result of an Army decision to increase funding in this effort to insure an effective soldier-to-machine interface for better performance of technologically complex systems.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Coordination of research is accomplished through annual DOD budget and apportionment reviews and through membership on tri-service committees such as the Human Factors Technology Coordination Group, the Human Factors Test and Evaluation Subgroup, and the DOD/National Aeronautics and Space Administration (NASA) Simulation Working Group. Additional coordination is obtained through participation on the NATO Working Group on Fidelity Requirements of Flight Simulation and the Technical Cooperation Program Panel on Human Factors in Command and Control Systems. There is direct coordination with the Air Force Human Resources Laboratory (AFHRL), Naval Personnel Research and Development Center (NPRDC), Army Project Manager for Training Devices (PM TRADE), Army Human Engineering Laboratory (HEL), and the Naval Training Equipment Center (NTEC) to cover related research in visual displays, training simulation, human factors in operational testing, and aviation crew performance. Data exchange among the Army Research Institute, related Army agencies, and other Services is used to eliminate unnecessary duplication of research. Memorandums of Understanding (MOU) have also been coordinated with research product users to insure effective research implementation.

F. (U) WORK PERFORMED BY: (Primary Contractors) Synthetics Corp., Fairfax, VA; Vector Research, Inc., Ann Arbor, MI; Applied Science Associates, Valencia, PA; Dunlap and Associates, Darien, CT; and Human Resources Research Organization, Alexandria, VA. There are three additional contracts that have a total value of \$180,000. The in-house developing organization responsible for this program is the US Army Research Institute (ARI), Alexandria, VA, and its field activities which are collocated with Army operational commands.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: A793 — Human Factors in Training and Operational Effectiveness: Training requirements must be addressed as a part of system design so training programs and simulation will be available to insure the effectiveness of the systems when they are fielded. With the introduction of systems that include one or more computers, there is the opportunity to "embed" a training capability within the systems. This research will provide techniques for early identification of system training requirements based on the needs of the human operators/maintainers and will specify appropriate approaches for new system training. The principal objectives of this program are: development of design specifications for training systems that can be "embedded" as an integral part of operational systems, development of methods for task estimation and description early in system development, identification of soldier performance requirements and the related training requirements.

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Program Element: #63798A

Title: Human Factors in Training and Operational Effectiveness

DOD Mission Area: #562 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

Identification of better methods for command staff training in command and control systems, and development of a comprehensive set of human factors guidelines and evaluation criteria for the design of user/operator transactions in battlefield automated systems. Project accomplishments include development of: procedures for evaluating design options for C3I systems, human factors guidelines for man-computer interface in Battlefield Automated Systems (BAS), preliminary procedures for controlling information in future command, control, and intelligence systems; new procedures for information collection planning, a handbook of tactical symbols for automated displays; manpower, personnel, and training issues for Army Systems Acquisition Review Council milestone review; questionnaires for human factors analysis of four developmental battlefield automated systems for use during operational test, recommendations for an improved format for portraying terrain relief, recommendations for color coding of computer-displayed maps which reduce human error by 30%, a handbook for human resources test and evaluation system (HRTES), human factors and training analysis considerations for design of an automated tactical data system testbed. FY 1983 milestones include: evaluation of a prototype training program for individual ready reserve (IRR) aviators, field validation of an aviator lexicon to be used in nap-of-the-earth communication and control procedures, documentation of computerized procedures for evaluation of probable enemy-courses-of-action and information collection planning, and field validation tests of human factors guidelines for battlefield automated systems. The FY 1984 planned program includes: research to improve techniques for information management in battlefield automated systems, field testing of criteria to assess the design features of battlefield automated systems; evaluation of the effectiveness of Aircrew training manuals, and implementing the use of improved tactical symbology in computerized battlefield and simulation systems. Efforts will be initiated to effectively integrate the soldier into the Air-Land Battle 2000 and the distributed battlefield by identifying the impact those scenarios have on the soldier and developing strategies to insure that the soldier will be prepared to fight in the anticipated environment. A major effort will be initiated to concentrate research on improving the Soldier-Machine Interface for distributed command and control systems. Specifically, the use of artificial intelligence and fault-tolerant design will be applied to vehicular-contained tactical decision systems to improve operational effectiveness by leveraging soldier capabilities. Similar applications will be incorporated in embedded training devices in both vehicular and portable tactical and maintenance devices.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 ROTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63742A

Title: Advanced Electronic Devices Development

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1588	3995	3810	5855	Continuing	Not Applicable
DF32	Advanced Electron Devices	1588	3995	3810	5855	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This advanced development program in electronic devices, component assemblies, and subsystems provides preplanned "technology insertion" product improvements into systems currently under development or in initial production, in order to assure qualitative superiority to Soviet systems. As such, the program is presently oriented on several high-priority systems such as the M1 Tank, Remotely Piloted Vehicles, Signals Intelligence Systems, and radars to assure their technology advantage. The highest priority research and exploratory development devices for which feasibility has been successfully demonstrated in technology base programs will be completed and demonstrated to meet specific Army needs in accordance with established system schedules. This program will permit—through major technology advances—the latest performance and cost improvements to be incorporated into ongoing systems developments so that technologically obsolete systems will not be fielded. Completion of these devices will provide enhanced combat performance, improved reliability levels, and cost effectiveness. New components will be completely developed and tested so that program managers can use them with acceptable risk rather than rely on 5- to 15-year-old technology. To obtain a commitment from system managers, it is vital that demonstrations of advanced devices and subsystems as called for in advanced development funding be carried out. Current efforts will provide a substantially better capability to fight a land war under the limited-visibility conditions of a contemporary battlefield and improved communications capability in the face of hostile jamming. This program is a part of the major Army technology thrust in Very Intelligent Surveillance and Target Acquisition (VISTA).

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Program Element: #63742A

Title: Advanced Electronic Devices Development

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	1588	3995	3810	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	2233	4006	4902	Continuing	Not Applicable

The reduction in FY 1982 is due to reprogramming of funds to higher Army priorities. Decrease in FY 1983 is due to pro rata application of general Congressional reductions to the RDTE, A appropriation. The reduction in FY 1984 is a result of realignment of Army priorities and the revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Coordination is achieved with other Government agencies through participation in the activities of the Department of Defense Advisory Group on Electron Devices (AGED). This and other informal coordination ensures no duplication of effort in this area.

F. (U) WORK PERFORMED BY: In-house: The Electronics Technology and Devices Laboratory, US Army Electronics Research and Development Command, Fort Monmouth, NJ. Principal contractors are: Sanders Associates, Merrimack, NJ; Varian Associates, Palo Alto, CA; Hughes Aircraft, Fullerton and Torrance, CA; United Technology Research Center, Hartford, CT; TRW, Redondo Beach, CA; Litton, San Carlos, CA; Bendix Corp., Towson, MD; Texas Instruments, Dallas, TX; Norden Systems, Norwalk, CT; and RCA, Camden, NJ.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: DF32 — Advanced Electron Devices: Traveling wave tubes (TWTs) have been developed for use in artillery and mortar-locating radars which have a life extension of 300% to 500% over presently used TWTs, providing significant cost reduction potential. Semiconductor diode devices have been developed that produce significant levels of millimeter-wave energy. These millimeter-wave sources are required in radar transmitters for the M1 tank to provide the capability to see through smoke and fog on the battlefield. Millimeter-wavelength equipment that can satisfy the requirement for visibility and target acquisition through smoke, fog, weather, and camouflage, at cost savings over present technology, will be developed and improved for use in weapons and communications systems. Improved, frequency-stable surface acoustic wave oscillators will be tested and delivered as replacement models to resolve radio-sonde frequency interference problems in Germany. The remaining Large and Very Large Scale Integrated Circuit Modules (3 each) for Advanced QUICKLOOK and GUARDRAIL Electronic

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Program Element: #63742A

Title: Advanced Electronic Devices Development

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

Warfare and Intelligence Systems will be designed, fabricated, and tested. The initial design and prototype models of the slow frequency-hopping synthesizer to improve the security of the Remotely Piloted Vehicle data links will be completed. Development will begin on a conformal "all electronic" scanning antenna that can be applied to the surface of tanks (M1) to reduce silhouette. This device is also applicable to the surface of terminal homing shells and missiles to eliminate mechanical gimbals. Ruggedized millimeter wave Integrated Circuit Receiver and Transmitter Modules will be delivered for evaluation in terminally guided munitions and for other military applications; i.e., Remotely Piloted Vehicles and missiles.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63743A

Title: Education and Training

DOD Mission Area: #662 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	8783	9737	11710	10882	Continuing	Not Applicable
A794	Education and Training	8783	9737	11710	10882	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The FY 1982 Defense Science Board (DSB) Summer Study on Training and Training Technology examined the training problems facing the three Services. Its focus was on the cost-effectiveness of current training and how modern technology could be used to make training both more effective and efficient (in terms of reducing the resources required to support training). The DSB study group concluded that special research emphasis is required for accelerating the use of computer-based instructional methods both in the "schoolhouse" and on-the-job by means of portable, "personal" training systems and training subsystems embedded in major weapon systems. This continuing program represents a comprehensive research effort to develop instructional technologies to meet both current and expected future training challenges. Research will emphasize the development of cost-effective training techniques in the areas of skill acquisition, retention and transfer. Specifically the research will examine: 1) individual and collective training for the maneuver arms, 2) maintenance training, 3) rotary-wing pilot training, and 4) leader training. There will also be increasing emphasis on the use of these training techniques for the Reserve Components. It is intended that successful applications of such technologies as microprocessors, videodisks, and voice synthesis/recognition devices will lead to higher skill levels, reduced training resource requirements, reduced training time requirements, and greater ease of cross-training in the unit setting. This element also provides funding for an approved computer system that will support the conduct of the total research program of the Army Research Institute (ARI), including its field units throughout the US. This program element helps to support the major technology thrust in Soldier-Machine Interface.

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Program Element: #63743A

Title: Education and Training

DOD Mission Area #552 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	8783	9737	11710	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	9361	9764	9820	Continuing	Not Applicable

Reduction of \$578 thousand in the FY 1982 funding level is a result of reprogramming to higher order priority Army requirements. The funding decrease of \$27 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. The net funding increase of \$1890 thousand in FY 1984 is a result of: reprogramming \$3 million into this program for the procurement of a computer system to support ARI's total research program, a \$1 million Army reprogramming for a higher priority research effort; and a \$10 thousand reduction for a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The results of Exploratory Development conducted under Program Element/Project 62722/A791 (Manpower, Personnel and Training) move to this Advanced Development project. Duplication of effort within the Army is avoided by annual Technology Base Reviews chaired by the Director of Army Research and within the Department of Defense by annual Apportionment Reviews chaired by a representative of the Office of the Under Secretary of Defense for Research and Engineering. Coordination is furthered within DOD through DOD Topical Reviews and participation on the Education and Training Technical Advisory Group (and the Job-Site Training Sub-TAG). Education and training research is coordinated directly with other Service research and development organizations, such as the Air Force Human Resources Laboratory (AFHRL), the Naval Personnel Research and Development Center (NPRDC), the Army's Project Manager for Training Devices (PM TRADE), and the Naval Training Equipment Center (NTEC) on a continuing basis through the Manpower and Training Research Information System (MATRIS) and an exchange of contractual Statements of Work. Further coordination is effected through Memorandums of Understanding with PM-TRADE and the US Army Soldier Support Center.

F. (U) WORK PERFORMED BY: (Primary Contractors) Anacapa Science, Inc., Santa Barbara, CA; American Institutes for Research, Washington, DC; Applied Science Associates, Inc., Valencia, PA; Advanced Resources Research Organization, Bethesda, MD; and the Human Resources Research Organization, Alexandria, VA. There are four additional contractors; the total value of the additional contracts is \$422,000. The in-house developing

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Program Element: #63743A

Title: Education and Training

DOD Mission Area: #552 — Environmental and Life
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

organization responsible for the conduct of this research program is the US Army Research Institute and its field activities which are collocated with Army operational commands.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: A794 — Education and Training

a. (U) Project Description: The training challenge facing the Army has increased significantly. Job-specific training requires increased training resources. Crews/teams and units must be trained to operate, maintain, and employ new and more complex weapon systems using doctrine geared to new wartime scenarios. The overall objective of this program is to develop training methods/techniques/systems that will lead to more effective, more efficient training. New information technologies will be used where it can be clearly demonstrated that they will lead to more cost-effective training. The specific objectives of research are the development and evaluation of training methods and techniques for: (1) basic skills training; (2) job-specific training, with special emphasis on maintenance, combat skills, and Army aviation; (3) collective training for the combat arms; (4) the measurement of individual and collective proficiency; (5) assessing the training effectiveness of new training systems; and (6) the management of training, with special emphasis on management within the unit.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Accomplishments under this project can be grouped in six categories: Basic Skills Training: design concept for a basic skills resource information center, evaluation of two basic skills Military Occupational Specialty (MOS)-oriented combat arms courses (MOS 05C and 31M). Individual Skills Training: Developed a task classification system for predicting skill retention. Guidelines for improved organizational and direct support maintenance training and evaluation, development of an M1 tank skill sustainment program, tank commander's guides for armor gunnery tasks, an advanced combat vehicle identification training program. Collective Skill Training: M1 tank crew drills; moving target engagement training Program of instruction, infantry Battle Drill training packages, battalion command group proficiency assessment techniques. Training Effectiveness Assessment: Assessment of M80A1/A3 tank gunnery devices, four job aids for evaluating training programs. Proficiency Assessment: prototype videodisc-based techniques for Skill Qualification Test administration, scoring aids for inflight student pilot evaluation. Training Management: design concept for an Army Training Evaluation Program feedback system.

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Program Element: #63743A

Title: Education and Training

DOD Mission Area: #552 -- Environmental and Life Sciences (ATD)

Budget Activity: #2 -- Advanced Technology Development

(2) (U) FY 1983 Program: Research in FY 1983 focuses on the development of training techniques for: 1) individual and collective training for the maneuver arms (infantry and armor), 2) maintenance training in units, 3) rotary-wing pilot training, and 4) the training of tactical leaders at all levels of command. A major research effort that does not conveniently fit under one of the above headings is research in support of Phase II development of the National Training Center (NTC) where the focus will be on improved training feedback techniques. A new emphasis for FY 1983 will be research on the application of computer-based techniques for Reserve Component training. Throughout this comprehensive training research program an attempt will be made to make cost-effective use of microprocessors, videodiscs and related electronic technologies; for example, prototypes of a handheld vocabulary tutor (employing microelectronics and speech synthesis technology) will be tested in a user environment for basic skills training. As another example, work will be undertaken to automate the tank commander's procedural guides which were completed in FY 1982.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: The FY 1984 program will continue much of the research from FY 1983. The research program will not change in terms of the areas studied (e.g., maintenance training); it will, however, change in terms of the relative emphasis placed on research in the various areas. There will be greater emphasis on technology-based training techniques for the Reserve Components (RC); the application of training techniques originally developed for one training purpose (e.g., basic skills) to RC training will be explored. Research in support of NTC Phase II development will continue; this effort will focus on the use of the wealth of high-fidelity unit performance data available at NTC for comparing alternative tactical doctrines, unit structures, personnel practices, etc. In FY 1984, this program element/project will also provide for the procurement of a software/hardware computing facility that will support the full range of ARI research both in Alexandria, VA, and at field units throughout the US.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63744A

Title: Training Simulation

DOD Mission Area: #552 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		2362	2783	3088	3827	Continuing	Not Applicable
A795	Training Simulation	2362	2783	3088	3827	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Army needs better, more cost effective training. There is an increasing emphasis on the development and use of simulators and training devices because of the high cost of using operational equipment for training, the high cost of live ammunition, the lack of suitable training sites, and the increasing complexity of modern weapon systems. Traditionally, simulation and training devices have been used in a school setting. There is an increasing need for them for training in units. The field setting poses new design problems in that the devices must be simpler to use and simpler to maintain. In addition, training in units requires a greater emphasis on the simulation of combat environments. The 1982 Defense Science Board's Summer Study of Training and Training Technology reaffirmed the pressing need for increased research to obtain more data on how well the Army currently trains soldiers and to determine how the Army can design more cost-effective simulation and training devices. Research under this program element is emphasizing the application of modern electronic technology to meet these training requirements for the Army and will provide simulator and training device design recommendations to the US Army Training and Doctrine Command (TRADOC) training developers and to the US Army Materiel Development and Readiness Command (DARCOM) Program Manager for Training Devices (PM TRADE) that will lead to more cost-effective training, primarily in units.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2362	2783	3088	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	2212	2790	3152	Continuing	Not Applicable

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Program Element: #63744A

Title: Training Simulation

DOD Mission Area: #552 — Environmental and Life
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

The increase of \$150 thousand in the FY 1982 funding level is a result of reprogramming to reflect increased emphasis on simulation and training device research. The funding decrease of \$7 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTEA appropriation. The funding decrease of \$64 thousand in FY 1984 resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The results of Exploratory Development research related to simulators and training devices conducted under Program Element/Project 62717/A790 (Human Performance Effectiveness and Simulation) move to this Advanced Development project. Duplication of effort within the Army is avoided by annual Technology Base Reviews chaired by the Director of Army Research and within the Department of Defense by annual Apportionment Reviews chaired by a representative of the Office of the Under Secretary of Defense for Research and Engineering (OUSDRE). Coordination of this research is furthered within DOD through DOD Topical Reviews and by participation in a number of subgroups of the Simulation Technical Advisory Group. Simulation and training device research is coordinated directly with the Defense Advanced Research Projects Agency (DARPA), the Army's Project Manager for Training Devices (PM TRADE), the Air Force Human Resources Laboratory (AFHRL), the Naval Personnel Research and Development Center (NPRDC), and the Naval Training Equipment Center (NTEC) on a continuing basis. Further evidence of efforts to minimize duplication of effort among DOD research and development activities are Memorandums of Understanding between the Army Research Institute for the Behavioral and Social Sciences and DARPA, PM TRADE, AFHRL, NPRDC, the US Army Training Support Center, and the US Army Training Developments Institute.

F. (U) WORK PERFORMED BY: American Institutes for Research, Washington, DC; Honeywell, Inc., Minneapolis, MN; and Decisions and Designs, Inc., McLean, VA. The Army developing organization responsible for the conduct of this research program is the US Army Research Institute (ARI) and its field activities which are colocated at Army operational commands.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: A795 — Training Simulation: With increasing emphasis being placed on the development and use of simulators and training devices, advanced information technology offers great potential for application to Army training in the development of improved, more cost-effective simulators and training devices. Modern computer technology is central to most simulators and training devices. Other technologies to be investigated are: (1) videodisc, (2) voice recognition/synthesis, (3) computer-generated imagery, (4) handheld personal computers, and (5) "embedded" training (using military systems' on-board computers for training). The objective of this research is to provide guidance that can be used by TRADOC and DARCOM (PM TRADE) in the design of more cost-effective simulators and training devices. This research emphasizes development of alternatives to the use of high-cost operational systems for acquiring and maintaining the complex operator, maintenance, and

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Program Element: #63744A

Title: Training Simulation

DOD Mission Area: #552 — Environmental and Life
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

decisionmaking skills required of a combat-ready force. Accomplishments during FY 1982 include: assessment of UH-60 flight simulator training effectiveness, validation of a flight simulator-based method for selecting helicopter pilots, detailed test plan for determining the extent to which flight simulators can substitute for actual aircraft flight time, instructional strategies for computer-based command and control group training (ARTBASS), recommendations for improving the Army's training device requirements definition process, and recommended design characteristics for Army general-purpose maintenance simulators. Goals for FY 1983 include: completion of training effectiveness evaluation of the CH-47 flight simulator, specification of revised training requirements for scout and attack helicopter crew members, development of training programs using flight simulators instead of actual aircraft, specifications for an automated procedure for assessing training device effectiveness, completing the evaluation of command and control training strategies, and analysis of requirements for simulation of tactical leader tasks. Goals for FY 1984 include: development of a detailed test plan for evaluating the training effectiveness of AH-1 flight simulators, a prototype training program for individualized command group staff member training, automated procedures for specifying training device design requirements, and preliminary specification of simulation requirements for tactical leader training. This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63748A

Title: Test, Measurement, and Diagnostic Equipment Development

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2969	7000	1836	496	Continuing	Not Applicable
DJ28	TMDE Technology Development	- 0 -	- 0 -	1418	- 0 -	Continuing	Not Applicable
DJ29	Automatic Test Support Systems (ATSS)	2869	6500	222	103	Continuing	Not Applicable
D244	ATSS Language Util & Stand	100	500	196	393	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element leads to production and fielding of test equipment by transferring today's automatic test equipment technology to hardware to overcome maintenance and supply problems in the field. These are caused by the increasing use of complex electronic and optical systems which are inherent in the design of the advanced technology systems being fielded by the Army. Maintenance of these systems using 1980's technology now requires highly trained repairmen, excessively large Automatic Test Equipment (ATE), or interim small-scale, special-purpose ATE. The objective of this program is a quantum improvement in maintenance support by fielding the fewest variations possible of type classified STANDARD high-technology (equal to or exceeding support systems) test equipment. Complementary ATE systems will be fielded to enable electronic technicians with considerably less training to troubleshoot and repair highly sophisticated electronic and optical systems. The Automatic Test Support System (ATSS) will be installed in a truck-mounted shelter and consists of a Base Station Test Facility (BSTF) and a manportable Contact Test Set (CTS), which will allow intermediate-level support maintenance on the forward battle area. ATSS will allow diagnosis and fault isolation on electronic assemblies removed at the organizational level from weapon systems or in a weapon system on-line mode by using the CTS. Both the large and the small ATEs are required to reduce incorrect diagnosis; reduce diagnostic time; reduce the variety of manual test equipment in the field; and reduce provisioning requirements and need for highly trained personnel. These efforts support the Army requirements for mobile ATE at division and corps levels. This effort includes vital complementary software efforts related to standard programming languages and software maintenance facilities to allow the maximum possible applications of expensive software development. Also included is the advanced development of test and isolation techniques, and methods, and test equipment to insure the capability of performing responsive and accurate malfunction identification, isolation, diagnosis, and failure prediction of Army systems, assemblies, and modules. Specifically, the development will address the design for testability of Army systems to include built-in test (BIT), provide demonstration models of pin electronics for digital testing of devices such as Very High Speed Integrated Circuitry (VHSIC), initiate a program to develop microwave and millimeter wave automatic testing capability, and develop software tools and programming aids for test program sets.

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Program Element: #63748A

Title: Test, Measurement, and Diagnostic Equipment Development

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2969	7000	1836	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	9619	11335	11519	Continuing	Not Applicable

Decrease in FY 1982 is due to a slip in execution of Advanced Development and reprogramming to higher priority Army requirement. Decrease in FY 1983 funding is a result of Congressional direction in the FY 1983 Appropriations Act. Reduced funding requirement in FY 1984 supports the transition of the program from Advanced Development to Engineering Development. Funds were transferred from this program element (#63748) into #64746.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Program Element #64746A (Automatic Test Support Systems) will support the Engineering Development work.

F. (U) WORK PERFORMED BY: In-house work is performed by the US Army Communications-Electronics Command, Ft. Monmouth, NJ; US Army Tank-Automotive Research and Development Command, Warren, MI. Contractors are: RCA Corporation, Burlington, MA; University of Pennsylvania, Philadelphia, PA; Ultrasystems, Irvine, Giordano Assoc, Sparta, NJ; Man-Tech International Corporation, Rockville, MD.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) DJ28 — TMDE Technology Development (NEW START): This project supports the advanced development of testing and evaluating techniques, methods, and test equipment to insure the capabilities of performing responsive and accurate malfunction identification, isolation, diagnosis, and failure prediction of Army systems, assemblies, and modules. This technology is essential in demonstrating the tools to achieve supportable future Army systems. This is a newly established project which will begin efforts in FY 1984 by addressing the design for testability of Army systems, provide demonstration models of pin electronics for digital testing of devices such as Very High Speed Integrated Circuitry (VHSIC), initiate a program to develop microwave and millimeter wave automatic testing capability, and develop software tools and programming aids for test program sets.

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Program Element: #63748A

Title: Test, Measurement, and Diagnostic Equipment
Development

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

2. (U) **DJ29 — Automatic Test Support System:** This project supports the advanced development effort for a single standard general-purpose automatic test support system (ATSS) to be used within the division and corps area. This system will be designed in modules to allow flexibility in maintaining multiple Army systems. The concept will be to plug in appropriate modules to enable the core computer to screen and maintain printed circuit boards and line-replaceable units within different types of systems. Presently, the Army develops single-system, special-purpose automatic test equipment to support each weapon system. In FY 1982 this program was restructured to execute Advanced Development in FY 1983, followed by Engineering Development in FY 1984. During FY 1982, system specifications and cost analysis were completed, and a Request for Proposal was generated. In FY 1983, multiple contractors will be solicited to provide detailed technical documentations of their capability to fulfill Army requirements. In FY 1984, two contractors will be selected to compete through early stages of Engineering Development (ED). A source selection process will choose a single contractor from the two to complete ED and proceed to production. The optics test capability will continue advanced development through FY 1986 and will be supported by this program element.

3. (U) **D244 — ATSS - Language Utilization and Standardization:** This project supports the development of the language to be used by the ATSS. This includes vital complementary software efforts related to standard programming languages and software maintenance facilities. During FY 1982, software specifications and costing were completed to support the generation of a request for proposal for ATSS. FY 1983 funds will support the software portion associated with Advanced Development of ATSS. This program element will continue to support the software development for the optic test capability in FY 1984.

H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:** Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63748A

Title: Technical Vulnerability Reduction

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	12899	10169	7948	7285	Continuing	Not Applicable
D462	Technical Vulnerability Reduction	12899	10169	7948	7285	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The need is to insure that US Army systems are hardened against current, projected, and reactive enemy threats. To meet this need, a US Army Materiel Development and Readiness Command (DARCOM) organization was established to be the single management focal point to ensure that counter-countermeasures (CCM) are incorporated into systems under development at any appropriate point from design to fielding. This program ensures that the above need is met through development/management of Army-wide CCM plans to counter enemy laser and radio frequency threats, performance of selected detailed analyses, coordination and integration of various Department of Defense efforts, and evaluation of CCM progress. CCM plans are based on systems performance analysis and the progress of CCM technology.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	12899	10169	7948	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	12899	10169	10234	Continuing	Not Applicable

Decrease in FY 1983 funding is due to pro rata application of general Congressional reductions to the RDTEA appropriation. Decrease in FY 1984 is due to realignment to higher priority Army requirements.

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Program Element: #63749A

Title: Technical Vulnerability Reduction

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The proper execution of a coordinated Army plan to harden its critical systems against enemy electronic warfare (EW) attempts requires interaction between the Training and Doctrine Command/Materiel Development and Readiness Command/Intelligence and Security Command (TRADOC/DARCOM/INSCOM). This program provides such interaction to insure that the newest technologies combined with optimized tactics and up-to-date intelligence provides effective and survivable weapons systems. All CCM-related efforts are contained within the overall plan which requires the additional interaction with TRADOC (requirements), the Army Medical Command, the Surgeon General, and the Army Hygiene Agency (eye protection). Within DARCOM, this office will monitor/guide the CCM-related work performed by the Office of Missile Electronic Warfare (OMEW) in PE #63718A (EW Vulnerability/Susceptibility). There is no unnecessary duplication of effort.

F. (U) WORK PERFORMED BY: Work under this program is performed by the US Army Development and Readiness Command Counter-Countermeasures (DARCOM CM/CCM) Center located at the US Army Electronic Research and Development Command (ERADCOM), Adelphi, MD. Specific DARCOM laboratories and product managers perform various parts of the work called for in the coordinated plan. Major contractors are the Physical Science Laboratory of Las Cruces, NM; Hughes Aircraft Co., Martin Marietta Aerospace; Science Applications, Inc; and the Illinois Institute of Technology Research Institute. There are 16 other contracts for \$2181 thousand.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D462 — Technical Vulnerability Reduction: The project is designed to insure that Army systems will operate effectively on the modern battlefield. The Soviet Union has committed substantial resources to develop an effective electronic warfare and countermeasures capability that will reduce the effectiveness of US weapons and communications systems. This project develops the counters to these Soviet developments. Field tests were conducted on the effectiveness of The was updated, and modifications to the communications/electronic warfare model completed to allow better analysis of systems vulnerability to advanced countermeasures systems. Vulnerability analysis of A test program to determine the vulnerability of electronic systems to threats and a Short-Range Air Defense Command and Control vulnerability analysis were initiated. The PERSHING II Missile threat analysis was reviewed. The FY 1982 program also initiated vulnerability assessments of the Joint Tactical Missile System (formerly CSWS), the Infantry Manned Anti-Armor Weapon System and smart weapons and smart, fire and forget weapons. In FY 1983 the program will evaluate progress and update the Battlefield vulnerability tests will be conducted to determine the highest priority for Army protection. Army activities designed to on the battlefield so that they can be destroyed will begin. The Army's radio frequency countermeasures hardening plan will be completed, and vulnerability assessments of distributed command, control and communications systems, very intelligent surveillance and target acquisition systems and directed energy weapons will be initiated. Vulnerability evaluations of the Short Range Air Defense Command and Control concepts will be completed as will an evaluation of general purpose automatic data processing equipment. Vulnerability assessments of the Infantry Manned Anti-Armor Weapons System and the Joint Tactical Missile System will be completed. The FY 1984 program

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Program Element: #63749A

Title: Technical Vulnerability Reduction

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

will continue work on the , and the battlefield vulnerability and effectiveness assessments will be completed. The assessment of distributed command, control and communications systems will be completed, and an evaluation of of weapons systems will begin.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1994: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #83752A

Title: Demilitarization Concepts

DOD Mission Area: #552 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	8507	12730	11278	8479	Continuing	Not Applicable
A994	Demilitarization Concepts	8507	12730	11278	8479	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Toxic munitions which are obsolete or leaking agent pose a potential hazard to the public and the environment. Experience with design, construction, and operation of chemical demilitarization facilities and equipment has confirmed the need for new technology to enhance safety, efficiency, and economy. Energy-efficient technology must be incorporated into all future chemical demilitarization designs. Current and increasing environmental constraints require advancement in the state-of-the-art for control of emissions. A concerted effort must be made to increase the safety of all chemical demilitarization operations. Detectors of sublethal levels of hazardous toxic agents in work area emission streams must incorporate the latest technology to prevent exposure of workers and the civilian population to even minute quantities of agent. Ultimate disposal of waste products under existing and new standards must also be addressed. Future demilitarization plants will require capacities two to six times larger than the existing Chemical Agent Munitions Disposal System (CAMDS) facility. Disposing of the entire current chemical agent stockpile will require capacities many times larger than even these planned facilities. Projected costs for stockpile disposal exceed \$2 billion if current technology is used. This research area provides the means to support present and future chemical demilitarization requirements with systems which are feasible, efficient, and environmentally acceptable.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	8507	12730	11278	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	9467	12766	13768	Continuing	Not Applicable

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Program Element: #63752A

Title: Demilitarization Concepts

DOD Mission Area: #552 — Environmental and Life
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

The initiation of this program in FY 1982 was delayed because of the provisions of the Continuing Resolution Authority. Therefore \$960 thousand was reprogramed to meet Army requirements of higher priority. The funding decrease of \$36 thousand in FY 1983 is the result of pro rata application of general Congressional reductions to the RDTEA appropriation. The funding decrease of \$2490 thousand in FY 1984 is a result of adjustments in scope of planned effort and refinements in estimated costs, and a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: There are currently no related projects. No unnecessary duplication of effort will occur within the Army or the Department of Defense. Open interchange of ideas with the Environmental Protection Agency and other non-Defense agencies avoids duplication in hazardous materials destruction. Large-scale destruction of toxic chemical agents and munitions is solely the responsibility of the US Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD.

F. (U) WORK PERFORMED BY: Approximately 90% of the research and development effort is performed under contract. Principal performers include; Midland Ross Corporation, Toledo, OH; Battelle Memorial Institute, Columbus, OH; Rockwell International Corporation, Los Angeles, CA; Gard Incorporated, Chicago, IL; General Atomic Company, San Diego, CA; and Southern Research Institute, Birmingham, AL. All contracts are monitored by the US Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: A984 — Demilitarization Concepts:

a. (U) Project Description: Project is designed to provide improved technology necessary to demilitarize existing stockpiles of obsolete chemical munitions and agents. Major thrust of this research and development effort will initially be devoted to development of alternative agent destruction processes. The ultimate objective is to develop a concept for a system capable of destroying both chemicals and explosives in a single efficient operation.

b. (U) Program Accomplishments and Future Efforts:

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Program Element: #63752A

Title: Demilitarization Concepts

DOD Mission Area: #552 — Environmental and Life
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

(1) (U) **FY 1982 Accomplishments:** This project was an FY 1982 new start. Major contractual efforts were awarded in agent destruction, munition processing, and detection and alarms. Literature searches were completed and industry surveys are in process. New concepts were evaluated for engineering and economic acceptability. A current technology system baseline was established for comparative analysis.

(2) (U) **FY 1983 Program:** Laboratory and bench scale evaluation and development of thermal processes for destruction of chemical agents GB, VX and H will be initiated. Laboratory evaluation and development of chemical processes for conversion of agents to reusable or easily disposable materials will be completed. Improved munitions and materials-processing concepts will be developed and demonstration testing evaluated.

(3) (U) **FY 1984 Planned Program and Basis for Budget Year Request:** Laboratory and bench scale evaluation and development of thermal processes for destruction of GB, VX, and H will be completed and a single process selected for pilot evaluation. Pilot evaluation of chemical processes for conversion of GB, VX, and H to reusable or easily disposable materials will be initiated. Prototype testing will be initiated to evaluate advance concepts for munitions disassembly, agent accessing, and explosives inerting.

(4) (U) **Program to Completion:** This is a continuing program.

c. (U) **Major Milestones:** Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63788A

Title: Advance Software Technology

DOD Mission Area: #551 -- Electronic and Physical Sciences (ATD)

Budget Activity: #2 -- Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	- 0 -	19293	26184	Continuing	Not Applicable
D082	Software Technology	- 0 -	- 0 -	19293	26184	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Virtually every system in the current and planned military inventory makes extensive use of computer technology. US technological leadership in the areas of electronics and computer hardware/software is essential for retaining US military supremacy. That technological lead is now threatened. Unless some effort is undertaken to exploit and build upon current or present technological lead and the personnel resources required to develop the technology, the US could lose its qualitative advantages in these areas. The Tri-Service Advanced Software Technology program has been established to advance the state-of-the-art and improve the state of practice to achieve software development and support that is faster, less expensive, and more predictable than present software. The improved software technology will enable the DOD to field more powerful, reliable, and adaptable weapon and weapon support systems. This program is being formulated under the direction of the Deputy Under Secretary of Defense for Research and Engineering (Research and Advanced Technology) DUSD(R&AT). Although the program formally begins in FY 1984, identification of the need and planning and preparation for the program have been underway for several years. A Joint Service Tri-Service Task Force is presently preparing a Program Management Plan and specifying the detailed tasks to begin upon program initiation. The program will be managed at the DOD level by a DOD/Tri-Service Office under the DUSD(R&AT).

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands) Not Applicable, New Program.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program is related to the following program elements: (1) The Air Force's Aerospace Avionics/VHSI Circuits (62204F), Command/Control/Communication (62702F), DOD Common Program Language (ADA) Advanced Development (63286F), Advanced Computer Technology (63726F), and Application for Information Processing Technology (64740F); (2) The Army's Defense Research Sciences (61102A), Tactical ADP Technology (62746A), and Command and Control (63723A); (3) The Navy's Command/Control technology (62721N) and Advanced Software/Computing Technology (63426N); and (4) The Defense Mapping Agency's Map/Chart/Geodesy INZ/Prototype Development (63701B). Close liaison across the programs will preclude duplication of effort.

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Program Element: #63756A

Title: Advance Software Technology

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

F. (U) **WORK PERFORMED BY:** The work for this program will be performed by Service laboratories such as the Army Institute for Research in Management Information and Computer Sciences, the Navy's Oceanographic System Center, and the Air Force's Rome Air Development Center. Contracts for the program will be, for the most part, competitive.

G. (U) **PROJECTS LESS THAN \$10 MILLION IN FY 1984:** Not Applicable

H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:**

1. (U) **Project: D082 — Software Technology (NEW START)**

a. (U) **Project Description:** The goal of the Software Technology project is to provide software for more powerful, reliable, and adaptable weapon and weapon support systems. The objective of the project is to improve software productivity while achieving greater software maintainability, reliability, and adaptability. Specific objectives are to: (1) improve personnel resources by increasing the level of expertise and expanding the expertise base; (2) enhance the power of software tools by improving project management, application-independent, and application-specific tools; and (3) increase software tool usage by improving business practices, usability, level of integration, and level of automation.

b. (U) **Program Accomplishments and Future Efforts:**

(1) (U) **FY 1982 Accomplishments:** Not Applicable, New Program.

(2) (U) **FY 1983 Program:** Not Applicable, New Program.

(3) (U) **FY 1984 Planned Program and Basis for Budget Year Request:** The prioritization of new tasks planned for FY 1984 will be determined in FY 1983 by the Tri-Service Task Force based on the initial plan prepared by OSD. New tasks to be started and completed are: (1) characterize the state-of-the-art in workstations and human engineering, computer architecture types, error types, fault-tolerances, and Validation and Verification (V&V) methods; (2) develop general baseline metrics; (3) establish academic program and plan course development and delivery mechanisms; (4) assign organizations responsible for learning aids including knowledge-based aids; (5) define application functions and data types for initial Ada package sets; and (6) analyze instances of highly successful software technology insertion to extract relevant characteristics. Tasks to be started and continued are: (1) analyses of initiative effectiveness; (2) instrument compilers and Ada Programming Support Environment (APSE); (3) baseline data collection to develop metrics; (4) define personnel career structure, incentives, and mechanisms; (5) develop and deliver nonacademic software courses; (6) develop academic program curricula; (7) evaluate, promulgate, and improve academic curricula; (8) establish scholarship program for DOD

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Program Element: #63756A

Title: Advance Software Technology

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

employees; (9) develop initial and management tool set; (10) design and develop initial Ada application package sets; (11) design and prototype the software development workstation; (12) plan human engineering research and development program; (13) experiment with intelligence assistance approaches; and (14) investigate and develop new support system methods.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable, New Program.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #83758A

Title: Artificial Intelligence (AI)/Robotics Demonstrators

DOD Mission Area: #551 — Electronic and Physical Sciences

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		- 0 -	- 0 -	7959	19827	- 0 -	27786
DK20 Artificial Intelligence/Robotics Demonstration		- 0 -	- 0 -	7959	19827	- 0 -	27786

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This effort will exploit the tremendous potential for increasing manpower effectiveness in combat, combat support, and combat service support offered by Artificial Intelligence (AI)/robotics technology. This program initiates five technology demonstrators which respond to the highest priority needs in AI/robotics expressed by the US Army Training and Doctrine Command. The five demonstrators are: a reconnaissance vehicle; an autonomous ammunition-handling module; a visual display of timely battlefield information for tank commanders; an intelligent maintenance tutor; and a knowledge-based system for medical aid.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands) Prior year efforts have separately evaluated the technical feasibility of critical elements of this program needed to transfer it from conceptualization to demonstration. It is a new program for FY 1984.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: There is no duplication of any of these programs within the Army or the Department of Defense. Related programs within DOD include technology base programs at the Navy Artificial Intelligence Center; Air Force research programs at the University of Michigan; the Defense Advanced Research Projects Agency-sponsored programs at Massachusetts Institute of Technology, Carnegie-Mellon University and Stanford University.

F. (U) WORK PERFORMED BY: The five demonstrators will be developed through the interaction of elements of the Army research and development community with primary participation and leadership as follows: reconnaissance vehicle, Engineer Topographic Laboratories; ammunition handling, Human Engineering Laboratory; vehicle integrated display, Army Research Institute and Tank-Automotive Command; maintenance tutor, Army Research Institute; medical aid, Army Medical Research and Development Command.

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Program Element: #63758A

Title: Artificial Intelligence (AI)/Robotics Demonstrators

DOD Mission Area: #551 — Electronic and Physical Sciences

Budget Activity: #2 — Advanced Technology Development

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: DK20 — Artificial Intelligence/Robotics Demonstration (NEW START): This is a new start program in FY 1984 and will conclude at the end of FY 1985. It provides an opportunity to assess the utility of emerging technologies. The program will concentrate upon integrating new techniques and equipment in the rapidly expanding field of "expert systems" and teleoperation acquired during the past five years in universities and industry. The demonstrators will incorporate state-of-the-art know-how for remote or autonomous operation in three broad technology areas: sensing and sensor fusion, manipulation and maneuver, and software for expert systems to control air or ground vehicles and weapons for training and for medical treatment. The planned efforts for FY 1984 and FY 1985 include: (1) Reconnaissance vehicle — Incorporation of a position/navigation capability into an existing armored vehicle together with onboard computers, stereo cameras, and display systems followed by demonstrating teleoperation of sensors and vehicle controls for selected battlefield missions; (2) ammunition handling — design and fabrication of components, integration, and feasibility demonstrations with military transporters are planned; (3) the vehicle-integrated display work will include timely battlefield information fusion algorithms and a demonstration of the rapid use of more than 330 data elements by the tank commander in selected critical missions; (4) maintenance tutor will involve design and integration of expert systems software for teaching maintenance and troubleshooting for the I-HAWK missile system; (5) expert medical systems will be adapted from the commercial sector to recall and rapidly display medical casualty identification, treatment, and triage. Complete project plans for each of the technology demonstrators have been prepared including responsibilities, schedules, baseline system and component description, technical approaches, operational scenarios, cost estimates, and project funding. While the demonstrators are funded through FY 1985, the lessons learned will assist Army developers and tacticians to observe the utility of this emerging, available technology for high-priority battlefield applications such as the generic examples supported by this program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63761A

Title: Electronic Warfare Vulnerability/Susceptibility
Technology Support

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	3445	8015			Continuing	Not Applicable
D190	Electronic Warfare Vulnerability/Sus- ceptibility Technical Support	3445	8015			Continuing	Not Applicable
D235	Missile Counter-Countermeasure Tech- nology	- 0 -	- 0 -			Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: An enemy's use of electronic warfare (EW) could greatly reduce the effectiveness of US Army electronic/electro-optical dependent systems; therefore, it is vital to determine the susceptibility to EW of the US Army missile and communications-electronic systems and provide to US Army developers recommendations on electronic counter-countermeasures circuits and devices for missile, communications-electronic, and night vision electro-optical systems that will reduce the vulnerability of US systems to enemy electronic warfare operations and enhance their survivability on the battlefield. The objectives of this program are: to develop advanced technology and applications for the above-mentioned electronic warfare analyses of US systems and the hardening of discovered weaknesses; to analyze foreign systems' EW vulnerabilities for US exploitation; to determine logical enemy electronic counter-countermeasure responses to US electronic warfare; and to provide guidance to the developers of the next-generation US electronic countermeasures systems.

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Program Element: #63761A

Title: Electronic Warfare Vulnerability/Susceptibility
Technology Support

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	3445	8015		Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	4450	8037		Continuing	Not Applicable

The decrease in FY 1982 funding reflects reprogramming to accommodate higher priority Army efforts. The funding decrease of \$22 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTEA appropriation. The decrease in FY 1984 funding reflects reprogramming to accommodate higher priority Army efforts and revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The work performed under this program element is directly related to the work being performed by other US Army Electronics Research and Development Command (ERADCOM) laboratories, particularly the Electronic Warfare Laboratory, Signals Warfare Laboratory, and Night Vision and Electro-Optics Laboratory. In particular, this work feeds directly into Program Element #63718A (EW Vulnerability/Susceptibility), Projects #D234 (Surface/Surface Weapons Electronic Warfare), #D267 (Air Defense/Missiles Vulnerability/Susceptibility), and #D626 (C³ Systems Vulnerability/Susceptibility). Results of the vulnerability/susceptibility investigations and electronic counter-countermeasure recommendations are furnished to other Army development commands; i.e., Missile Command and the Communications-Electronics Command. Efforts in this program are related closely to scientific and technical programs conducted by the US Air Force Program Element #63718F (Electronic Warfare Technology), #63743F (Electro-Optical Warfare), #63750F (Counter-Countermeasure Advanced Development), #62204F (Active Electronic Countermeasures), and #6327F (Communications Vulnerability Assessment); the US Navy Program Element #62762N (EMC) and #63713H (Laser Countermeasures) (CM/CCM); and other programs within the US Army (#62303A (Missile Technology) and #65804A Electronic Proving Grounds). Exploratory staff development under Program Element #62715A, Project #A042, directly supports this program. Coordination is accomplished by exchange of technical reports, attendance at scientific meetings and conferences, joint development projects, and reviews by the Department of the Army and by the Office of the Secretary of Defense Under Secretary of Defense for Research and Engineering (USDRE). Duplication is precluded by active participation of personnel in interagency working groups, liaison visits to agencies involved in electronic warfare related scientific and technical work, the free exchange of information agencies via the Defense Technical Information Center, and deliberate structuring of the program to concentrate on the

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Program Element: #63761A

Title: **Electronic Warfare Vulnerability/Susceptibility
Technology Support**

DOD Mission Area: #551 — **Electronic and Physical
Sciences (ATD)**

Budget Activity: #2 — **Advanced Technology Development**

Army's electronic warfare needs. Where areas of potential duplication exist, memorandums of agreement have been effected with the command/agency concerned; e.g., with the Air Force's Communications Vulnerability Assessment Program or the Army's Electro-Optical Test Facility. Membership exists in various working groups and committees.

F. (U) WORK PERFORMED BY: ERADCOM has primary responsibility for execution of Project D190, and Missile Command had the primary responsibility for execution of Project D235. In-house research, development, and electronic warfare vulnerability/susceptibility is conducted by ERADCOM (White Sands Missile Range, NM). In-house generic missile electronic counter-countermeasure research and development is conducted by the Missile Command, Redstone Arsenal, AL. Major contractors are: Atlantic Research Corporation, Alexandria, VA; Physical Science Laboratory, New Mexico State University, Las Cruces, NM; BDM Corporation, Huntsville, AL; TRW Corporation, Redondo Beach, CA; and DESCRIPT, Inc., El Paso, TX. Contractors will perform approximately 10 contracts with a total dollar value of approximately \$1,200,000.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) **D190—Electronic Warfare Vulnerability/Susceptibility Technical Support:** The purpose of this project is to develop advanced electronic warfare technology and applications, to determine the susceptibility/vulnerability of Army weapon and communication-electronics systems, to develop electronic counter-countermeasure hardening of discovered weaknesses, and to determine foreign systems' electronic warfare vulnerability. The susceptibility/vulnerability posture of Army systems is required to provide the electronic counter-countermeasures hardening necessary to enhance the systems' survivability on the battlefield. FY 1982 accomplishments include: ; conduct of compartmented program laboratory investigations; completion of tri-Service electronic countermeasure tests versus ; modification of ; aircraft maneuvers with and without countermeasures incorporated for use with ; ALQ-159/ALQ-162 versus under test; subsystem fabrication on schedule; completion of and Stinger-POST simulation; publication of Multiple Launch Rocket System signatures vulnerability report; measurement of; and supported device development. FY 1983 plans include: Complete Stinger-POST and TOW-2 investigations; begin coupling analysis of SADARM and Remotely Piloted Vehicle, and develop techniques; conduct compartmented program electronic countermeasure laboratory and field investigations; package in M-130 dispenser; measure chaff; conduct effectiveness analysis and compare M-130 chaff; complete ; evaluate electronic warfare susceptibility of distributed command post and robust/survivable communication concepts; initiate test planning and perform electronic warfare analysis of system design concept; conduct independent electronic countermeasure vulnerability assessments of ; provide measurements for Stinger-POST Army Systems Acquisition Review Council III inputs; determine PATRIOT infrared launch detection susceptibility; provide SADARM electronic countermeasure environment and FY 1984 plans include: Complete SADARM and Remotely Piloted Vehicle investigations; begin 155-mm fire-and-forget guided projectile and night CHAPARRAL investigations; continue compartmented program electronic countermeasure field experiments; produce design Outlaw Indian (transition from 6.2) battlefield radar experiment; complete studies on investigation and verify countermeasure designs; initiate electronic warfare susceptibility assessment of packet radio

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Program Element: #63761A

Title: Electronic Warfare Vulnerability/Susceptibility
Technology Support

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

concepts; initiate electronic warfare susceptibility assessment of techniques; prepare and coordinate test requirements; initiate electronic warfare equipment development program; evaluate conceptual design to identify susceptibilities; evaluate electronic counter-countermeasure techniques through simulation and laboratory investigations; provide CHAPARRAL-Rosette, SADARM, measurements; begin development for CHAPARRAL-Rosette, device vulnerability; and begin for SADARM, Division Support Weapon System Measurements.

2. (U) **D235 Missile Counter-Countermeasure Technology:** The purpose of this project is to develop electronic counter-countermeasure technology and its applications to harden Army missile systems in a modern electronic warfare battlefield environment. The electronic counter-countermeasure hardening is needed to enhance the survivability of Army missile systems on the battlefield. Because this project is a new start, no FY 1982 accomplishments are listed here, nor any FY 1983 plans (funding begins in FY 1984). FY 1984 plans include: Generic electronic counter-countermeasure techniques and a technology base for the protection of threats will be developed; specific efforts are investigations. Generic electronic counter-countermeasure techniques and a technology base for the protection of from electronic warfare threats will be developed; specific efforts are investigations and investigations and applications to radio frequency/infrared seekers.

H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:** Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63762A

Title: Electronic Warfare Feasibility Development

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	4982			Continuing	Not Applicable
DK15	Advanced Communications Electronic Countermeasures Demonstration	- 0 -	1978			Continuing	Not Applicable
DK16	Combat Vehicle Self-Protection Demon- stration	- 0 -	3004			Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The effective use of electronic warfare (EW) will be one of the most effective combat multipliers on the modern battlefield. The ability to reduce the enemy's command and control by disrupting his communications and to protect our forces from detection and from radar, electro-optical, and infrared guided weapons may spell the difference between victory and defeat in any future conflict. The rapidly increasing use of precision-guided weapons necessitates a corresponding effort in the detection and countering of such threats. Investigations and developments are continuing, in close coordination with the intelligence community, to insure that the latest developmental US missile, communications, electronics and electro-optic systems will function satisfactorily in a hostile countermeasures environment. This program element provides the funding to demonstrate the feasibility and effectiveness of electronic warfare developments emerging from the Army's Tactical Electronic Warfare Technology program. Items successfully demonstrated in the program will then make the transition to advanced development. Rapid buildup of funding is required to enable the Army to keep its countermeasures systems current in today's high-technology environment that is characterized by substantial increases in communications systems capability every few years.

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Program Element: #63762A

Title: Electronic Warfare Feasibility Development

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	- 0 -	4982		Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	- 0 -	4995		Continuing	Not Applicable

Decrease of \$13 thousand in FY 1983 is due to pro rata application of general Congressional reductions to the RDTE,A appropriation. Increase of \$1652 thousand in FY 1984 is due to an increase in the priority of future communications electronic countermeasures capability which resulted in reprogramming from lower priority Army programs.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program is to continue the developments and conduct feasibility demonstrations of efforts begun in Program Element #62715A (Tactical Electronic Warfare Technology). Successful developments will make the transition to advanced development under Program Element #63755A, (Tactical Electronic Countermeasures Systems). Tri-Service technical efforts in electronic warfare receive extensive review as a result of participating in Joint-Service Technical Programs, Electronic Counter-Countermeasure Workshops and Joint Technical Coordinating Technology Coordinating Paper on Electronics and the annual reviews by the Under Secretary of Defense for Research and Engineering.

F. (U) WORK PERFORMED BY: Elements of the US Army Electronics Research and Development Command, Adelphi, MD, consisting of the Electronic Warfare Laboratory, Fort Monmouth, NJ, and the US Army Signals Warfare Laboratory, Warrenton, VA. The major contractor is Martin Marietta Corp, Orlando, FL. Other contractors are still to be determined.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

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Program Element: #63762A

DOD Mission Area: #551 — Electronic and Physical
Sciences (ATD)

Title: Electronic Warfare Feasibility Development

Budget Activity: #2 — Advanced Technology Development

1. (U) **DK15 — Advanced Communications Electronic Countermeasures Demonstration:** For US electronic warfare systems to be effective on the modern battlefield it is essential that they be kept current and able to meet new developments in Soviet communications. Modern communications technology is advancing rapidly, and communications systems are beginning to use advanced techniques such as spread spectrum and frequency hopping. These advanced techniques will rapidly make fielded electronic warfare systems obsolete. This project demonstrates the advanced technology necessary to counter the communications systems of the future and insure that, as the Soviets improve their communications systems, the US will have a countermeasure available. The FY 1983 program (the first year of this project) will consist of initiation of development.

2. (U) **DK16 — Combat Vehicle Self-Protection Demonstration:** The US Army continues to plan to fight the war in Europe outnumbered in tanks. To be effective, there needs to be some way to degrade the Soviets' target acquisition capability and allow US tanks. The STINGRAY Combat Vehicle Self-Protection System is designed to provide the Army with that capability. The system uses a STINGRAY will be mounted on the main battle tank to. In FY 1982 a technology base-developed prototype was demonstrated at Ft. Knox, KY, and resulted in user support to enter the technology demonstration phase. In FY 1982 a request for proposal was released and the development contract awarded using Program Element #63710, Project DK87, funding. The development of the system will continue through FY 1983 and FY 1984 and be tested in FY 1985. This program will provide equipment for testing on M1 Tanks and Light Armored Vehicles. If the FY 1985 tests are successful, STINGRAY will make the transition to full-scale development under Program Element #64750A.

H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:** Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63763A

Title: Industrial Base/Biological Warfare Vaccines and Drugs

DOD Mission Area: #552 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	4937	9589	17823	Continuing	Not Applicable
D807	Industrial Base/BW Vaccines and Drugs	- 0 -	4937	5157	10444	Continuing	Not Applicable
D810	Industrial Base/Vaccines and Drugs	- 0 -	- 0 -	4432	7379	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element funds nonsystems advanced development for production of standard lots of pharmaceutical-grade drugs and vaccines. This effort will provide financial incentive for the pharmaceutical industry to undertake the private capital commitment required to develop militarily unique drugs for which there is no public market. Production will be directed towards those pharmaceuticals which can be used against known or suspected biological warfare (BW) agents and against militarily important infectious diseases. The manufacturing base will be used to produce large pilot lots of vaccines for administration to at-risk military personnel and to establish minimum stockpiles. Requirements are identified in the Long-Range Research, Development, and Acquisition Plan, Letters of Agreement, and Letter Requirements. This program is part of the Army thrust in Biotechnology.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	- 0 -	4937	9589	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	- 0 -	4951	5354	Continuing	Not Applicable

The FY 1983 decrease is the result of pro rata application of general Congressional reductions to RDTE,A appropriation. The FY 1984 increase is a result of the addition of a new project (Project D810, Industrial Base/Vaccines and Drugs) to this program element.

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Program Element: #63763A

Title: Industrial Base/Biological Warfare Vaccines and Drugs

DOD Mission Area: #552 — Environmental and Life Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development Tactical Programs

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program element is supported by: Program Element #61102A (Defense Research Sciences), Project BS10A (Military Disease Hazards Research), and Project BS12 (Science Base/Medical Defense Against BW); Program Element #63770A (Military Disease Hazards Technology), Project A870 (DOD Medical Defense Against Infectious Diseases) and Project A871 (Medical Defense Against BW). This program element is very closely related to systems advanced development in Program Element #63750A (Drug and Vaccine Development), Project D808 (DOD Drug and Vaccine Development), and Project D809 (Drug and Vaccine Development/Medical Defense Against BW). Products transfer from both of these 6.3 program elements to Program Element #64758A (Drug and Vaccine Development), Project D847 (Drug and Vaccine Development/Medical Defense Against BW), and Project D849 (Drug and Vaccine Development). At the direction of the Congress, Army and Navy infectious disease research efforts were consolidated in FY 1982 into a single DOD program with the Army designated lead agent and responsible for planning, programing, and budgeting for the DOD infectious disease program. Navy scientists will continue to participate in the execution of the program. The consolidation plan will prevent any duplication of effort between the two Services.

F. (U) WORK PERFORMED BY: Approximately 1 percent of the effort will be performed by in-house laboratories at the US Army Medical Research Institute of Infectious Diseases, Fort Detrick, Frederick, MD; the Walter Reed Army Institute of Research, Washington, DC; and the Naval Medical Research Institute, Bethesda, MD. The remaining 99 percent of the work will be conducted under contracts. The sole contract for FY 1983 is with the Salk Institute, Swiftwater, PA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D807 — Industrial Base/BW Vaccines and Drugs: This is a new start in FY 1983. The initial funding will support establishment of an industrial base in the United States for the production of pharmaceutical-grade compounds and vaccines identified in exploratory development to be effective against biological warfare agents. Development efforts will include synthesis and pilot lot production of large lots of materials required for safety, efficacy, and toxicity testing needed to support new drug or vaccine applications. In FY 1984, development will proceed on drugs and vaccines effective against anthrax, botulism, Q Fever, and various hemorrhagic fevers.

2. (U) D810 — Industrial Base/Vaccines and Drugs: This project will be devoted to establishing an industrial base to produce large lots of pharmaceutical-grade drugs and vaccines to be used against infectious diseases affecting mobilization and deployment. In FY 1984, large standard lots of promising drugs and vaccines on which safety and efficacy have been demonstrated in animal tests will be produced; e.g., hepatitis and gonococcus vaccines and antileishmanial drugs.

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Program Element: #63763A

Title: Industrial Base/Biological Warfare Vaccines and Drugs

DOD Mission Area: #562 — Environmental and Life
Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development
Tactical Programs

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63765A

Title: Nontactical ADP Technology

DOD Mission Area: #551 — Electronic and Physical Sciences (ATD)

Budget Activity: #2 — Advanced Technology Development

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	- 0 -	- 0 -	- 0 -	Not Applicable	Not Applicable
DY13	Nontactical ADP Technology	- 0 -	- 0 -	- 0 -	- 0 -	Not Applicable	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Program Element: Army managers of software systems need decision-aiding tools that will facilitate the planning, control, and reporting of projects throughout the Automated Data Systems Life Cycle. This program was to be a combined effort between the Army Institute for Research in Management Information and Computer Sciences (AIRMICS) and Support Group Fort Lee with a primary objective of developing a microcomputer interactive decision support system (DSS) for assisting software life-cycle planning and management, and a secondary objective of demonstrating DSS capabilities within the Army. The program element would have provided follow-on advanced development of an Automated Requirements System and Automated Project Management System originating in program element 62725A, Computer and Information Sciences, Project DY10. Specific needs to have been addressed by this program included: (1) Design, develop, test, and evaluate a prototype Automated Requirements System to assist the user, proponent, and developer in formulating, stating, analyzing, and validating system requirements; (2) design, develop, test, and evaluate a prototype Automated Project Management System to aid software project managers in the allocation, scheduling, and control of resources during the software development life cycle.

C. (U) EXPLANATION OF CANCELLATION OR DEFERRAL: During the FY 1983 Congressional budget review, the Armed Services Committees did not authorize this program as a new start. The funds for FY 1984 and FY 1985 were reallocated to a higher priority Army program. The program has been deferred.

UNCLASSIFIED

UNCLASSIFIED

FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #12814A

Title: Special Program

DOD Mission Area: #331 — Strategic Command and Control

Budget Activity: #3 — Strategic Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							.
D333	Special Program					.	.

* Outyear and total estimated costs are available upon request in accordance with paragraph B below.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Program content is TOP SECRET - Limited Distribution, Special Access Required, precluding further description in this summary. Access to information in this program is controlled by the Deputy Under Secretary of Defense for Command, Control, Communications and Intelligence, Office of the Secretary of Defense. The Army is Executive Agent for a portion of this program.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)*				.	.
Funds (as shown in FY 1983 submission)				.	.

* Details on intrayear RTDE funding changes, as well as outyear and total estimated costs, are available upon request in accordance with paragraph B above.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands)

UNCLASSIFIED

UNCLASSIFIED

Program Element: #12614A

Title: Special Program

DOD Mission Area: #331 — Strategic Command and Control

Budget Activity: #3 — Strategic Programs

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement, Army: Funds (current requirements)						

* Details on procurement funding requirements, as well as outyear and total estimated costs, are available upon request in accordance with paragraph B above.

E. (U) RELATED ACTIVITIES: Available upon request in accordance with paragraph B above.

F. (U) WORK PERFORMED BY: Program information is available upon request in accordance with paragraph B above.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Program information is available upon request in accordance with paragraph B above.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Program information is available upon request in accordance with paragraph B above.

UNCLASSIFIED

UNCLASSIFIED

FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #12821A

Title: **CLASSIFIED PROGRAM**

DOD Mission Area: #331 — Strategic Command and Control

Budget Activity: #3 — Strategic Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -				CLASSIFIED	CLASSIFIED
	QUANTITIES						CLASSIFIED
D338	CLASSIFIED PROGRAM	- 0 -				CLASSIFIED	CLASSIFIED

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Program content is SECRET/No Foreign Dissemination, precluding further description in this summary. Classification authority and access are controlled by the Deputy Chief of Staff for Research, Development, and Acquisition, Department of the Army.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)		- 0 -		CLASSIFIED	CLASSIFIED
Funds (as shown in FY 1983 submission)		- 0 -		CLASSIFIED	CLASSIFIED

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: See paragraph B above.

F. (U) WORK PERFORMED BY: Both in-house and under contracts.

UNCLASSIFIED

UNCLASSIFIED

Program Element: #12821A

Title: **CLASSIFIED PROGRAM**

DOD Mission Area: #331 — Strategic Command and Control

Budget Activity: #3 — Strategic Programs

G. (U) **PROJECTS LESS THAN \$10 MILLION IN FY 1984:** Details may be provided upon request.

H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:** Details may be provided upon request.

UNCLASSIFIED

UNCLASSIFIED

FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #33152A

Title: WWMCCS Information System Modernization Program

DOD Mission Area: #391 — Information Systems

Budget Activity: #3 — Strategic Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	- 0 -	9454	16230	Continuing	Not Applicable
DH86	Army WWMCCS Information System (WIS)	- 0 -	- 0 -	9454	16230	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: In response to Congressional mandates, the Department of Defense instituted the Worldwide Military Command and Control System (WWMCCS) Information System (WIS) Modernization Program by approval of the Joint Mission Element Need Statement (JMENS) for this program in December 1981. This program provides for WWMCCS Automatic Data Processing (ADP) system redesign and replacement of the current ADP hardware and software by the late 1980s. The research, development, test, and evaluation dollars shown are required for redesign and conversion of current WWMCCS-Standard and Site-Unique WWMCCS-supportive software to be usable on the new WWMCCS Information System (WIS) computers. In addition, funds have been included to provide for redesign, conversion, and development of WIS-Standard software at the direction of the Secretary of Defense. These funds will be transferred to the WIS Joint Program Manager (JPM)/Air Force WIS Special Program Office (SPO). The WIS-Standard hardware will be provided by the WIS JPMO/AF WIS SPO in the 1986-1991 timeframe. Initial funding is required to develop software specifications. Scheduling of the software redesign and conversion is compatible with presently known WIS JPM plans for WIS hardware installation. Without these funds, the Army WWMCCS peacetime, crisis, and wartime missions cannot be accomplished by the eight Army-supported WWMCCS sites.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands) This project is a new requirement. For this reason, there is no comparable project included in the FY 1983 Congressional Descriptive Summaries. This new requirement results from Secretary of Defense approval of the WIS Modernization Program. The estimated project costs have been derived from the WIS JPM-adopted mathematical model, which projects estimated effort required to convert or redesign software to permit the updated software to be run by the computers to be selected in the WIS Modernization Program. It is expected that the project estimates will be refined as the WIS Modernization Program matures.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

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Program Element: #33152A

Title: WWMCCS Information System Modernization Program

DOD Mission Area: #391 — Information Systems

Budget Activity: #3 — Strategic Programs

E. (U) RELATED ACTIVITIES: Not Applicable.

F. (U) WORK PERFORMED BY: A systems design contractor is expected to be selected in 1984.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: DH86 — Army WWMCCS Information System (WIS) (NEW START): FY 1984 research, development, test, and evaluation funds will be transferred to the WIS JPM to initiate WIS-Standard software development to include development of prototype system, local area network, automated message-handling capability, prototype for secure module, program design language, and support for Joint Program Management (JPM) Office and Special Project Office. Funds are Army's pro rata share of \$45 million dollars programmed in FY 1984 to support the WIS JPM effort.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

UNCLASSIFIED

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63304A

Title: **Ballistic Missile Defense Advanced Technology Program**

DOD Mission Area: #121 — **Ballistic Missile Defense**

Budget Activity: #3 — **Strategic Programs**

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	126494	142833			Continuing	Not Applicable
D215	BMD Advanced Technology	126494	142833			Continuing	Not Applicable

* Non-Security Exemption

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Ballistic Missile Defense (BMD) Advanced Technology Program is a broadly based research and development effort designed to exploit new and emerging technologies seeking improved cost-effective methods to perform BMD. The US is faced with a growing Soviet ballistic missile threat and must continue to advance and develop the technologies required to provide options to counter this threat. The program is essential to assure that persistent Soviet efforts do not further erode the level of BMD capability that the US has maintained since the 1972 ABM Treaty became effective.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	126494	142833		Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	126494	143243		Continuing	Not Applicable

* Non-Security Exemption

The funding decrease of \$410 thousand in FY 1983 is a result of pro rata application of general Congressional reduction to the RDTE, A appropriation. The increase in FY 1984 is of the endoatmospheric nonnuclear kill research and development program. This program is developing the technology required to provide BMD a low altitude nonnuclear kill capability. and high-fidelity simulation of the engagement is underway. This program is necessary to ensure timely development of nonnuclear kill capability for BMD, continue advanced research and developments to provide BMD the capability of

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Program Element: #63304A

Title: **Ballistic Missile Defense Advanced Technology Program**

DOD Mission Area: #121 — **Ballistic Missile Defense**

Budget Activity: #3 — **Strategic Programs**

preventing technological surprise by threat nations. A FY 1984 reduction of \$2632 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Military Construction, Army Funds (current requirements)	- 0 -	20000			- 0 -	

*** Non-Security Exemption**

The MCA funding is to provide an aircraft hangar and technical support facility for the modified C-135B, Optical Aircraft Measurements Program (OAMP) aircraft. The facility will provide aircraft shelter, crew quarters, maintenance and storage facilities, as well as technical support facilities and a quick-look data analysis capability. The MCA funding is to provide facilities to support the QUEEN MATCH program.

E. (U) RELATED ACTIVITIES: The Ballistic Missile Defense Advanced Technology Program is fully coordinated with related programs being sponsored by other Army, other DOD, and other Government agencies. Included are: Program Element (PE) #61102A (Army Materials and Mechanics Research Center); PE #62303A, PE #61603, PE #63007A, PE #64313A (US Army Missile Command); PE #63627A (US Air Force Ballistic Missile Office); PE #62601F (US Air Force Weapons Laboratory); PE #12208N (US Naval Supply Weapons Center); and PE #62702E, PE #62301E (Defense Advanced Research Projects Agency). Transfer mature technology to the BMD Systems Technology Program (PE #63306). Every effort is made to prevent duplication of effort through automated literature searches, coordination meetings, memorandums of agreement, etc.

F. (U) WORK PERFORMED BY: The five major contractors are: Massachusetts Institute of Technology, Lincoln Laboratory, Lexington, MA; Rockwell International Corporation, Anaheim, CA; McDonnell Douglas Astronautics Company, Huntington Beach, CA; Hughes Aircraft Company, Fullerton, CA; and Nichols Research Corporation, Huntsville, AL. There will be approximately 100 additional contractors and other Government agencies for an additional value of \$99 million. The organization responsible for the program is the Ballistic Missile Defense Advanced Technology Center, Huntsville, AL.

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Program Element: #63304A

Title: Ballistic Missile Defense Advanced Technology Program

DOD Mission Area: #121 — Ballistic Missile Defense

Budget Activity: #3 — Strategic Programs

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: D215 — Ballistic Missile Defense (BMD) Advanced Technology Program

a. (U) Project Description: The BMD Advanced Technology Program remains abreast of BMD advanced development, aggressively searching for and exploiting innovative concepts and guarding against technological surprise. The program involves advancing the state-of-the-art in multiple technologies through component/subsystem fabrication and demonstration. It will develop and validate technology and concepts to provide the United States BMD options and assist in the refinement of US strategic offensive force capability.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: The fifth flight of the Designating Optical Tracker (DOT) Program was successfully conducted at the Kwajalein Missile Range. This flight demonstrated the capability of long wavelength infrared (LWIR) sensors to perform ballistic missile defense (BMD) operational functions of A C-135B aircraft was acquired for the LWIR sensor platform in the Optical Aircraft Measurements Program (OAMP). The OAMP will obtain The COBRA JUDY radar, an S-band phased array radar on the United States Navy Ship (USNS) OBSERVATION ISLAND, became operational and is providing data to both the US Army and US Air Force Gallium arsenide (GaAs) technology was initiated which will develop the nation's first GaAs microprocessor, a technology which provides faster data processing and nuclear hardness. This country's first two-section 95.5 gigahertz gyrotron traveling wave tube was developed and tested

(2) (U) FY 1983 Program: The Advanced Technology Program will continue research and development in the technology areas of radars, optics, data processing, discrimination, interceptors, and ballistic missile defense construct analysis. The millimeter wave instrumentation radar will become operational at Kwajalein Missile Range. Low-altitude efforts will focus on component development and tests to support a low-altitude nonnuclear kill deployment capability. Develop simulation in order to utilize Small Radar Homing Intercept Technology (SRHIT) flight test data from the BMD System Technology Program. Testing will continue The Optical Aircraft Measurements Program C-135B aircraft will be modified High-altitude efforts will focus on Analysis and evaluation of field measurements data will continue. Technology base efforts will focus on:

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: The low-altitude defense nonnuclear kill technology development program will continue Additional efforts include

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Program Element: #63304A

Title: **Ballistic Missile Defense Advanced Technology
Program**

DOD Mission Area: #121 — **Ballistic Missile Defense**

Budget Activity: #3 — **Strategic Programs**

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63308A

Title: Ballistic Missile Defense Systems Technology Program

DOD Mission Area: #121 — Ballistic Missile Defense

Budget Activity: #3 — Strategic Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	335615	376234			Continuing	Not Applicable
D991	BMD Systems Technology Program	335615	376234			Continuing	Not Applicable

*Non-Security Exemption

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Ballistic Missile Defense (BMD) Systems Technology Program (STP) provides for the development of active defense systems to counter the ballistic missile threat to the US. The program is structured to provide the capability to rapidly develop and deploy, if necessary, BMD in support of the strategic modernization program. The program is based upon an aggressive research and development program integrating technology advances into BMD system concepts, defining, and validating the performance of components incorporating maturing technologies. The program is structured to provide options for deployment of a ballistic missile defense system, if a decision is made to do so, and for intensive research and development effort to assure the latest technology and ability to provide evolutionary improvements with the most advanced and effective components available. The STP is essential to assure availability of BMD systems to counter advanced Soviet threats to the US, to maintain survivability of the US ICBM force, and to protect other high-priority military targets.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	335615	376234		Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	335615	727311		Continuing	Not Applicable

*Non-Security Exemption

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Program Element: #63308A

Title: Ballistic Missile Defense Systems Technology Program

DOD Mission Area: #121 — Ballistic Missile Defense

Budget Activity: #3 — Strategic Programs

The funding decrease of \$351,077 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act and pro rata application of general Congressional reductions to the RDTEA appropriation. The FY 1984 estimate has been decreased to \$547,200 thousand, due to the decreased emphasis on near-term deployment planning resulting from the Presidential decision not to deploy BMD at this time to defend Peacekeeper in Closely Spaced Basing (CSB). The remaining FY 1984 reduction of \$8820 thousand resulted from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Military Construction, Army Funds (current requirements)	- 0 -	- 0 -			Continuing	Not Applicable

***Non-Security Exemption**

Test facilities will be constructed at White Sands Missile Range (WSMR) to support interceptor subsystem testing and at Kwajalein Missile Range (KMR) for system integration and testing. Existing facilities at both ranges will be utilized where possible. New facilities at both ranges will include launch cells, ground support equipment, refurbishment, and test support buildings. WSMR will require new launch control facilities and a missile assembly building. KMR will require a new launch checkout facility.

E. (U) RELATED ACTIVITIES: The BMD Systems Technology Program (STP) is fully coordinated with related programs sponsored by other Army, other DOD, and other Government agencies. Included are the Army Materials and Mechanics Research Center (PE #61102A), Army Missile Intelligence Agency, and the Air Force Strategic Missile Systems program (PE #63322F). Coordination of the Air Force and Army Strategic Programs is accomplished through the Strategic Executive Committee within the Department of Defense and by close liaison with Air Force development and user organizations. STP utilizes mature technology transferred from BMD Advanced Technology Program (PE #63304A). Every effort is made to prevent duplication of effort through automated literature searches, coordination meetings, memorandums of agreement, etc.

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Program Element: #63388A

Title: Ballistic Missile Defense Systems Technology Program

DOD Mission Area: #121 — Ballistic Missile Defense

Budget Activity: #3 — Strategic Programs

F. (U) WORK PERFORMED BY: Major contractors include: McDonnell Douglas Astronautics Company, Huntington Beach, CA; Lockheed Missile and Space Co., Sunnyvale, CA; Teledyne Brown Engineering Co., Inc., Huntsville, AL; Raytheon Company, Wayland, MA; Martin Marietta Aerospace Corporation, Orlando, FL. There will be approximately 60 additional contractors and other Government agencies for an additional value of \$148 million. The developing organization responsible for the program is the Ballistic Missile Defense Systems Command, Huntsville, AL.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: D881 — Systems Technology Program

a. (U) Project Description: The Systems Technology Program is pursuing a vigorous research and development program to support the President's strategic defense initiatives, contribute to a stable and secure deterrent, and increase Soviet incentive to negotiate genuine arms reduction. This overall program involves the development and demonstration of a capability to defend hardened strategic targets and other high-value assets. The program is designed to demonstrate improved capabilities of a full spectrum of defense concepts and maintain a ballistic missile defense system hedge option for Peacekeeper in CSB (Closely Spaced Basing). At any given time, the option to complete development and deploy the most current components in an integrated system will be available. Research and development will be conducted to provide the technology and capability to augment the initial system. This improved deployment option involves development of an endoatmospheric nonnuclear kill (ENNK) capability; demonstrating the effectiveness of an Airborne Optical Adjunct for the radars; an exoatmospheric (high altitude) defense system; and examining the viability of nonconventional systems such as

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: The Homing Overlay Experiment (HOE) mission and launch control equipment and associated software were fabricated, tested, and validated. The ground test vehicle was fabricated and used to verify all ground test, checkout, and support equipment. The first flight test vehicle, consisting of live boosters and a homing and kill stage, was tested and delivered to Kwajalein Missile Range in preparation for flight tests in FY 1983. Fabrication of the LWIR optical homing sensors was completed. In addition, Endo Atmospheric Non Nuclear Kill (ENNK) system and a high-endoatmospheric/low-exoatmospheric system using the SPARTAN missile as the interceptor was defined; extensive systems analysis was accomplished to determine BMD effectiveness supporting various Peacekeeper basing modes, including CSB; X-band data were successfully gathered on live ICBM missions using the signature measurement radar; and hardware tests were accomplished on various SENTRY-D subsystem components such as: interceptor aerodynamic characteristics in wind tunnel flight stability tests, motor case strength tests, radar face hermetics and component tests, and vibration and shock tests of numerous components. Extensive coordination continues with the Air Force to define

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Program Element: #63308A

Title: **Ballistic Missile Defense Systems Technology Program**

DOD Mission Area: #121 — **Ballistic Missile Defense**

Budget Activity: #3 — **Strategic Programs**

system interfaces between Peacekeeper (in several basing modes) and BMD concepts in order to maximize survivability of a defended Peacekeeper deployment.

(2) (U) **FY 1983 Program:** The STP will emphasize a broad-based research and development program designed to develop and demonstrate components and subsystems which will provide an evolutionary growth capability in current and future BMD system concepts. During FY 1983, STP will: requirements; initiate an experimental flight test effort called Small Radar Homing Intercept Technology (SRHIT) to benchmark current ENNK technology; ; conduct system performance trade-off, complete preliminary design concept, initiate system design, and ; continue development of the Sentry D radar and data processor; and . Continue close coordination with the Air Force to assure that BMD concepts optimize survivability of Peacekeeper in its designated basing mode and further define interface requirements. STP will maintain a hedge option for defense of Peacekeeper.

(3) (U) **FY 1984 Planned Program and Basis for Budget Year Request:** Complete the ground test portion of the SRHIT program. studies for an ENNK prototype demonstration program. Initiate concept definition studies and preliminary design of critical components for a High-Altitude Defense System. A calibration facility will be selected and modifications begun for the optical sensor testing. Continue development of the Sentry D radar and data processor. Continue close coordination with the Air Force to assure that BMD concepts optimize survivability of Peacekeeper in its designated basing mode and further define interface requirements. Maintain hedge option for defense of Peacekeeper.

(4) (U) **Program to Completion:** This is a continuing research and development program. Its nature may change dramatically based on a Presidential decision on deployment of a BMD system to defend ICBMs.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #23724A

Title: Heavy Antitank/Assault Weapon System (TOW)

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	6724	1976	1896	3892	Continuing	Not Applicable
D336	Heavy Antitank/Assault Weapon System (TOW)	6724	1976	1896	3892	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The TOW (tube-launched, optically tracked, wire-guided) is a long-range anti-tank/assault guided missile weapon system. The missile is automatically tracked and command guided to the gunner's line of sight. TOW is needed to provide the Army and Marine Corps a long-range (3750 meters) antiarmor capability. The TOW complements the other antiarmor weapon systems; i.e., tanks, DRAGON, and LAW, to provide the Army and Marine Corps an in-depth capability to defeat enemy armor forces. Without the TOW, the infantry and mechanized forces will not have a long-range antiarmor capability. Improvements are currently in process to improve the performance of TOW against advanced enemy armor and countermeasures.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	6724	1976	1896	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	6509	1981	1987	- 0 -	205527

The funding increase of \$155 thousand in FY 1982 is a result of reprogramming to complete development of TOW2. The funding decrease of \$5 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE,A appropriation. The funding decrease of \$71 thousand in FY 1984 resulted from a revision of the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #23724A

Title: Heavy Antitank/Assault Weapon System (TOW)

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement, Army (MIPA)						
Funds (current requirements)	107650	133100	189200	210100	1144821	2781321
Quantities (current requirements)	10008	12000	18000	18000	82628	303188

The funding increase of \$10550 thousand in FY 1982 is a result of inflation adjustments and reprogramming of Foreign Military Sales Funds to replace diverted US Stock ITOW missiles with the more potent TOW2 missiles. Decrease of 1992 missiles in FY 1982 is a result of underestimate of cost of TOW2 missiles during development phase of program. The funding decrease of \$12100 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act. The funding decrease of \$34700 thousand in FY 1984 is a result of program restructure to allow procurement of launcher modification kits and \$17900 thousand decrease in funds by DOD. Quantity of missiles is not affected. Increase of \$805422 thousand in Total Estimated Cost is a result of increase of 78588 in the TOW2 missiles to be procured. Total estimated cost includes BASIC, ITOW and TOW2 missiles. Total estimated cost for TOW2 is \$1618300 thousand. Total quantity of missiles include BASIC, ITOW, TOW2 and practice missiles. Total TOW2 missiles to be procured is 144,500.

E. (U) RELATED ACTIVITIES: The TOW night sight was the pilot program for developing common components for manportable night vision devices based on imaging infrared technology. Components developed for the TOW night sight are also used in such systems as the Medium Antitank Assault Weapon (DRAGON) night tracker (Program Element (PE) 23727A), the Night Observation Device Long Range (NODLR) (PE 64710A, Night Vision Devices), and the Ground Laser Locator Designator (GLLD) (PE 64308A, Precision Laser Designators). A TOW Cover Artillery Protect (TOW-CAP) was completed as a quick fix using a ballistic blanket to provide protection for TOW crews against artillery fire. A modified M113A1 armored personnel carrier has been fielded to provide a TOW crew with armor protection and tracked vehicle mobility (Improved TOW Vehicle, ITV, M901 PE 63626A). The TOW System is also being mounted on the COBRA helicopter (PE 64212A) and Fighting Vehicle Systems (PE 64616A and 64628A). There is no unnecessary duplication of effort within the Army or Department of Defense on the TOW program.

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Program Element: #23724A

Title: Heavy Antitank/Assault Weapon System (TOW)

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

F. (U) WORK PERFORMED BY: The major contractors are Hughes Aircraft Company, Culver City, CA; Emerson Electric Company, St. Louis, MO; and Texas Instruments Incorporated, Dallas, TX. Army management of the TOW Weapon System is performed by the TOW Project Manager, US Army Missile Command, Redstone Arsenal, AL.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D336 — Heavy Antitank/Assault Weapon System (TOW): This project provides for development of penetration and guidance improvements to the TOW missile system. TOW is the primary antiarmor weapon of the infantry forces. The improvements to TOW are required in order to maintain the infantry's capability to defeat an evolving Soviet armor threat and to allow operation in battlefield obscuration and electro-optical countermeasure (EOCM) environments. The FY 1982 RDTE program finalizes efforts on TOW2 guidance and EOCM hardware. The FY 1982 program also included procurement of TOW2 missiles and modification kits to convert basic TOW launchers to the TOW2 configuration. The FY 1983 RDTE effort will provide for development of software to integrate TOW2 Test Measurement and Diagnostic Equipment (TMDE) with the Electronic Quality Assurance Test Equipment (EQUATE). Deliveries of TOW2 missiles and TOW2 launcher modification kits will begin in FY 1983. The FY 1984 RDTE effort will complete development of software to integrate TOW2 TMDE with EQUATE. Deliveries of the TOW2 missiles and launcher modification kits will continue throughout FY 1984.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #23726A

Title: Advanced Field Artillery Tactical Data System

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT QUANTITIES		4792	11004	31906	31984	Continuing	Not Applicable 4
D322	Advanced Field Artillery Tactical Data System	4792	11004	31906	31984	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Within the broad mission of US land forces, which is to defeat the enemy by combat operations, the fire support mission area specifically encompasses the field artillery functions of providing continuous and timely target servicing, counterfire, and interdiction fires to the maneuver forces. The Field Artillery Tactical Fire Direction (TACFIRE) automated command and control system greatly increases the effectiveness of our forces. However, a successor system development is required to provide the capability to the field artillery to defeat the threat envisioned for the late 1990s. This new system must provide for improved communications management, distributed processing capability at remote locations, and increased system mobility and survivability. The Advanced Field Artillery Tactical Data System will take full advantage of new hardware technology, such as interactive graphic displays, to substantially ease training and improve operability. It will incorporate standardized, smaller, less costly, and more reliable processors and remote terminals to allow distribution of currently centralized functions, and will provide a reduction in the physical size of the artillery command and control centers, thereby enhancing survivability in the tactical field artillery environment.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	4792	11004	31906	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5958	7224	28446	Continuing	Not Applicable

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Program Element: #23726A

Title: Advanced Field Artillery Tactical Data System

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

Reduction of \$1166 thousand in the FY 1982 funding level is a result of the program's initiation late in the year and the consequent reprogramming of funds to other Army high-priority requirements. The funding increase of \$3780 thousand in FY 1983 funding is a result of reprogramming funds for the High Technology Light Division. The increase in FY 1984 is provided to support the High Technology Light Division.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement, Army:						
Funds (current requirements)	- 0 -	- 0 -	- 0 -	- 0 -	763000	763000 ¹
Quantities (current requirements)	- 0 -	- 0 -	- 0 -	- 0 -	139	139 ¹
Military Construction, Army						
Funds (current requirements)	- 0 -	- 0 -	- 0 -	- 0 -	3400	3400 ²

¹ (U) The current quantity and costs reflect replacement of TACFIRE with the new system for the total Active Force. A decision on fielding the new system to the reserves is deferred to a later date. No change from FY 1983.

² (U) The Military Construction, Army funds shown cover a requirement for construction of a secure climatized vault for classified disks/tapes, etc., as well as construction of laboratory space for 90 additional personnel. The space and vault are necessary for the Field Artillery Tactical Data System Software Support Group at Ft. Sill, OK. No change from FY 1983.

E. (U) RELATED ACTIVITIES: The following provides information on current US and foreign development efforts which may be applicable to this program:

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Program Element: #23726A

Title: Advanced Field Artillery Tactical Data System

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

1. (U) A standard, 32-bit militarized computer is being developed in Program Element (PE) #62746A (Tactical ADP Technology), Project #A09400 (Military Computer Family) and PE #63723A (Command and Control), Project D186 (Military Computer Family). This computer is scheduled to enter production in FY 1986 and, if available, will be used as the processor for the new system. Since no central processing unit will be developed under this program element, duplication of effort cannot occur.
 2. (U) A Department of Defense standardized software language, Ada, is being developed in Program Element #63723A (Command and Control), Project #D185 (Military Software Standardization). Ada will be used in all software programming.
 3. (U) The Marine Corps is developing the Marine Integrated Fire and Air Support System (MIFASS). Because of differences in doctrine and operational procedures, the total Marine Corps System is not expected to satisfy Army requirements. Components of MIFASS will be evaluated by the Army, however, to determine whether these components can be adapted to meet the new system needs. Duplication will be avoided through close liaison between offices, through letters, visits, and analysis of technology and hardware as it is developed.
 4. (U) Both the United Kingdom and Germany are developing systems which approximate the current functions of TACFIRE. Although doctrinal differences may result in the selection/development, by these countries, of equipment that is unsuitable for US Army needs, subsystems of these systems will be evaluated for potential use. Duplication will be avoided by frequent visits between offices and analysis of technology and hardware as it is developed.
- F. (U) **WORK PERFORMED BY:** The system design and support contract was awarded to Calculon Corporation in September 1981. It is planned to competitively award separate contracts for the development of each of the subsystems and for verification and validation. The Advanced Development Contract for the Communication Control Subsystem was awarded to Singer Librascope, Glendale, CA. The in-house developing agency is the US Army Communications Electronics Command (CECOM), Ft Monmouth, NJ.
- G. (U) **PROJECTS LESS THAN \$10 MILLION IN FY 1984:** Not Applicable.
- H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:**
1. (U) **Project: D322 — Advanced Field Artillery Tactical Data System**
 - a. (U) **Project Description:** The Army is fielding the automated Tactical Fire Direction System (TACFIRE) to provide accurate, responsive, effective utilization of US artillery, which is numerically inferior to that of our potential adversary. The user has identified a requirement for a replacement system for the 1990s that must incorporate three specific improvements, all of which are supportable with technology projected to be available in

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Program Element: #23726A

Title: Advanced Field Artillery Tactical Data System

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

the near term. In order of priority, these requirements are: (1) better communications management, (2) the availability of data processing capability at remote locations, and (3) a reduction in the size and weight of the Fire Direction Center (FDC) subsystem. This program is to field a new system to replace TACFIRE, meeting all the new user requirements. The new system will employ a front end communications processor which will handle a variety of communications message structures, speeds, modulation types, error correction coding, security, and communications media; i.e., radio, wire line, switched system, and dedicated data systems such as the Position Locating and Reporting System/Joint Tactical Information Distribution System Hybrid. Current microprocessor technology will allow placing these parameters under software control, thus providing fielded operational flexibility to efficiently match all emerging communications and sensor systems. The techniques and characteristics required to significantly enhance artillery tactical communications net management must be completed and demonstrated prior to completing the balance of the system design. Since this subsystem must therefore be developed early, it is possible to utilize this part of the new system to improve the current TACFIRE's tactical communications net management capabilities until the successor system can be fully fielded. The user's requirement for data processing at remote locations will be accommodated with the continuing technological advances in the areas of processors and displays, resulting in significant improvements in size, cost, and reliability. In order to further reduce system cost and logistics, the new standard military computer family processor and memory now under development will be used for the intelligent remotes and the Fire Direction Centers. These new remote subsystems will increase overall system survivability by physically distributing the data base and processing locations, and will improve system responsiveness by providing the necessary processing capability to the Fire Support Officer, who must support the maneuver force commander. Interactive graphics will be used throughout the new system to alleviate operation and training shortcomings of the current system. Finally, improved reliability, ruggedness, and reduced size of new support subsystems should make it possible to configure the new FDCs into vehicles common to the supported forces. When completed, the replacement system will be entirely new, utilizing proven applications software evolved from the current TACFIRE system. The modification and recoding of the current and ongoing software enhancements of the TACFIRE application software will be accomplished by the existing TACFIRE post-deployment software support group. All contracts for subsystem hardware will be awarded competitively. Fully competitive production procurement data packages will be procured for each subsystem.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: The systems contractor will continue to analyze user needs, concentrating on the detailed functional characteristics of new intelligent terminals to improve system responsiveness to the commander's needs. The communication control subsystem contractor began assembly of a brassboard model to be incorporated in testbed tests planned for mid-FY 1983. System software modifications were initiated to provide a user testbed evaluation. Development continued on software verification and validation.

(2) (U) FY 1983 Program: Fabrication of the brassboard models of the Communication Control Subsystem (CCS) and development of the system-level software for the testbed will be completed. The CCS testbed will be conducted, and the results analyzed. Engineering design specifications for the engineering development models of the CCS will be completed. The system engineering contractor will complete the remote terminal

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Program Element: #23726A

Title: Advanced Field Artillery Tactical Data System

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

subsystem functional analyses and specifications, and conduct a preliminary evaluation of software system design. Action will be initiated to procure Military Computer Family processors for use in the remote subsystem software development. Design requirements for the Fire Direction Center subsystem will be initiated based on cost/performance/risk trade-off analysis and a continuing assessment of available and projected near-term technology. The High Technology Light Division will be supported by providing an interim lightweight fire support prototype terminal which will function as a test case for AFATDS.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: The CCS will enter Engineering Development. The contract for the Fire Support Officer device and Fire Integration Support Team Chief Remote Intelligent Terminals will be awarded. The TACFIRE application software conversion to the standard DOD programming Language (Ada) for Advanced Field Artillery Tactical Data System will be initiated. The Fire Direction Center (FDC) subsystem requirements will be completed, and procurement action for an FY 1985 development start will be initiated.

(4) (U) Program to Completion: The systems contractor will continue to define the details of the functional and material improvements to be made to the advanced system to allow it to be fully responsive to the user's projected needs into the 21st century. Each of the improvements will be thoroughly tested with the user at Ft Sill in a testbed of operational and brassboard hardware and software. The user will be given the opportunity for hands-on examination of the improvements prior to design finalization and subsequent formal tests. Additionally, selected subsystems will be evaluated in the interoperability testbed for automated systems at Ft Hood. The CCS is planned to be fielded in FY 1988. The remote devices and FDCs will be fielded in FY 1991.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
Mission Element Need Statement Approved	2Q 1981	2Q 1981
In-Process Review (IPR) (CCS)	4Q 1981	4Q 1981
Contract Award (CCS)	3Q 1982	3Q 1982
Development Test (DT)/Operational Test (OT) II (CCS)	2Q 1986	3Q 1986
Development Acceptance In-Process Review (DEVA IPR)	4Q 1986	4Q 1986

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Program Element: #23726A

Title: Advanced Field Artillery Tactical Data System

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

<u>Major Milestones</u>	<u>Current Milestone Dates</u>	<u>Milestone Dates Shown in FY 1983 Submission</u>
Initial Operational Capability (IOC) (CCS)	3Q 1988	3Q 1988
Army Systems Acquisition		
Review Council I (ASARC) (Remote De- vices/FDC Upgrade)	3Q 1983	3Q 1983
Contract Award	1Q 1984	1Q 1984
DT/OT II (Remote Devices/FDC Upgrade)	4Q 1988	4Q 1988
ASARC III (Remote Devices/FDC Up- grade)	1Q 1989	1Q 1989
IOC (Remote Devices/FDC Upgrade)	1Q 1991	1Q 1991

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #23730A

Title: CHAPARRAL

DOD Mission Area: #214 — Ground-Based Anti-Air And
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT QUANTITIES	23598	24706	23615	14554	3871	199910
	Fire Units						5
	Missiles					60	223
D697	CHAPARRAL	23598	24706	23615	14554	3871	199910

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the development of missile, launch station, and carrier improvements for the CHAPARRAL weapon system. CHAPARRAL is a highly mobile self-propelled short-range air defense surface-to-air missile system. The missile is lightweight, supersonic, passive infrared homing, fire-and-forget. CHAPARRAL is effective against all types of aircraft at low altitude. The system has been operationally deployed since 1969. It provides air defense for infantry, mechanized infantry, and armor divisions and for critical theater/corps rear area assets, to include air bases. CHAPARRAL will be retained in the Army's active inventory through the 1990s. To enable CHAPARRAL to meet the postulated threat through the 1990s, critical system improvements are required. These include missile improvements to provide increased engagement range and countermeasures hardening, a collective crew nuclear, biological, and chemical protection system and Weapon Display Unit to provide target early warning information from the Short-Range Air Defense Command and Control System.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	23598	24706	23615	18425	199910
Funds (as shown in FY 1983 submission)	19616	26381	24518	12250	196320

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Program Element: #23730A

Title: CHAPARRAL

DOD Mission Area: #214 — Ground-Based Anti-Air And
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

FY 1982 Increase due to reprogramming to replace funds reduced in FY 1981. Reduction in FY 1983 resulted from proposed reprogramming for Compartmented Programs and pro rata application of general Congressional reductions to the RDTE,A appropriation. The FY 1984 reduction resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget. Increase in funds to complete was caused by delay in initiating the Rosette Scan Seeker (RSS) development program.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement, Army: CHAPARRAL (MIM-72-A/ C)						
Funds (current requirements)	4300	- 0 -	- 0 -	3200	802900	1304000
Quantities (current requirements)						
Missiles	- 0 -	- 0 -	- 0 -	- 0 -	6645	19965
Fire Units	- 0 -	- 0 -	- 0 -	- 0 -	12	544*

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Program Element: #23730A

Title: CHAPARRAL

DOD Mission Area: #214 — Ground-Based Anti-Air And
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement, Army: CHAPARRAL Modifications Funds (current requirements)	83900	32100	12400	202600	72600	498200

* 12 Sold to Israel.

1. (U) Explanation, changes in Missile Procurement, Army: CHAPARRAL (MIM-72-A/C). Increase reflects addition of funds for twelve towed CHAPARRAL Systems for the High Technology Light Division.

2. (U) Explanation, changes in quantities. Addition of twelve towed CHAPARRAL in FY 1986.

3. (U) Explanation, change in Missile Procurement, Army: CHAPARRAL Modification. Funds were added in FY 1984 for Smokeless Rocket Motor (SRM) repour, air-compressor modification kits and SRM insulation. Funds were added in FY 1985 to buy-out the FLIR program. Funds were added in FY 1986 for a FLIR counter-countermeasures improvement program.

E. (U) RELATED ACTIVITIES: ROLAND (Program Element 64309A), STINGER (Program Element 64306A), Division Air Defense (DIVAD) Gun (Program Element 64131A), Lightweight Air Defense System (LADS) (Program Element 63323A) and the High Technology Light Division (HTLD) Towed Chaparral (Program Element 64323) are complementary programs. Duplication of effort is avoided by CHAPARRAL project office coordination with the Naval Weapons Center, China Lake, CA, developer of the SIDEWINDER missile, the US Army Missile Command Laboratories, which maintain cognizance of Army and other Service programs, and through coordination with the STINGER, ROLAND, and DIVAD Gun project offices.

F. (U) WORK PERFORMED BY: The CHAPARRAL ground equipment was developed and procured through Ford Aerospace and Communications Corporation (formerly Aeronutronic Ford), Newport Beach, CA. The Basic CHAPARRAL missile (MIM-72A), was procured by military interdepartmental procurement request through the Navy. The Improved CHAPARRAL Missile (MIM-72C) was developed and procured through Ford Aerospace. The

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Program Element: #23730A

Title: CHAPARRAL

DOD Mission Area: #214 — Ground-Based Anti-Air And
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

contractor for the CHAPARRAL carrier, M730, which is provided as Government-furnished equipment to Ford Aerospace, is Food Machinery Corporation (FMC), San Jose, CA. Ford Aerospace was the prime contractor for development of the Forward Looking Infrared (FLIR) Night Sight with Texas Instruments Incorporated (TI), Dallas, TX, a major subcontractor. Production of FLIR subassemblies is performed by TI and Ford is producing interface kits. The US Army Missile Command, Huntsville, AL, is the in-house developing organization responsible for the program.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: D887 — CHAPARRAL

a. (U) Project Description: Program provides for development of Rosette Scan Seeker (RSS) missile guidance to provide increased missile engagement range and improved infrared counter-countermeasures and Weapon System product improvements. The product improvements are: a Weapon Display Unit to provide the gunner target alerting and cueing information from the Short-Range Air Defense Command and Control System, Forward Looking Infrared Night Sight infrared counter-countermeasures, and a Nuclear, Biological, and Chemical (NBC) Protection System to provide the crew protection for operation in an NBC environment.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Development of the Rosette Scan Seeker missile guidance was initiated.

(2) (U) FY 1983 Program: Development of the Rosette Scan Seeker guidance continued. Development was initiated for the Weapon Display Unit, Nuclear, Biological, and Chemical Crew Protection System, and for the Night Sight infrared counter-countermeasures.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Rosette Scan Seeker guidance development will continue. The Weapon Display Unit, Nuclear, Biological, and Chemical Crew Protection System, and Night Sight infrared counter-countermeasures development efforts will be completed.

(4) (U) Program to Completion: Contractor Rosette Scan Seeker development effort will be completed, and technical data package will be prepared by the contractor. The Government test and evaluation will be accomplished and the guidance section type classified.

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Program Element: #23730A

Title: CHAPARRAL

DOD Mission Area: #214 — Ground-Based Anti-Air And
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
Initiate Rosette Scan Seeker Development	4Q FY 1982	Not Shown
Complete Rosette Scan Seeker User Test		Not Shown
Rosette Scan Seeker Initial Operational Capability IOC ¹		
Forward Looking Infrared Night Sight Initial Operational Capability		
Forward Looking Infrared Night Sight Counter-Countermeasures Initial Operational Capability		Not Shown
Weapon Display Unit Initial Operational Ca- pability		Not Shown
Nuclear Biological Chemical Protection System Initial Operational Capability		Not Shown

¹ RSS development schedule was compressed based on contractor's effort under Internal Research and Development effort.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #23731A

Title: Surface-to-Air Missile HAWK/HAWK Improvement Program (SAM HAWK/HIP)

DOD Mission Area: #214 — Ground-Based Antiair and Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT QUANTITIES	39414	36363	33543	28326	18041	349766
	Missiles/Ground Support Equipment Sets						
D690	Surface-to-Air Missiles HAWK/HAWK Improvement	39414	36363	33543	28326	18041	55/2 349766

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Improved HAWK (IHAWK) is a mobile, day and night, all-weather surface-to-air missile (SAM) system designed to destroy high-performance aircraft in the low- to medium-altitude/range spectrum. IHAWK has been deployed since 1972. A Product Improvement Program (PIP) was initiated in FY 1973. Army plans call for a phased series of PIPs or modifications to be applied to fielded equipment. The first set of PIPs (Phase I) completed fielding in 1981 and are designed to correct significant field problems associated with IHAWK's acquisition radars and data link capability. A follow-on set of improvements (Phase II) will begin fielding in 1983. Development work on Phase III began in April 1982. Phase III consists of improvements to ground equipment to upgrade IHAWK system effectiveness, maintainability, and survivability to meet the expected threat of the late 1980s. In addition, a series of missile modifications will be fielded to keep pace with enemy jamming techniques.

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Program Element: #23731A

Title: Surface-to-Air Missile HAWK/HAWK Improvement Program (SAM HAWK/HIP)

DOD Mission Area: #214 — Ground-Based Antiair and Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	39414	36363	33543	46367	349766
Funds (as shown in FY 1983 submission)	39435	37971	27125	17632	316241

Decrease of \$0.021 million in FY 1982 is due to an inflation adjustment. The funding decrease of \$1.608 million in FY 1983 is a result of reprogramming of funds for Compartmented Programs (\$1.5M) and inflation adjustments (\$0.108M). Increase of \$6.418 million in FY 1984 is due to a change in the design requirements of one of the Phase III product improvements dealing with upgrading the Platoon Command Post. The increased development costs will fund the additional engineering effort and prototype fabrication. Based on a 20 January 1982 Army decision to retain a portion of the IHAWK force indefinitely, additional RDTE requirements for FY 1985 and beyond will be completed in the coming months. The \$26.735 million increase in "Additional to Completion" is to begin work to reconfigure field maintenance equipment to support Phase III modified systems and conduct required analysis/technology demonstrations to keep HAWK viable against the threat. A determination will also be made as to what evolutionary changes (if any) are required beyond the current approved Phase III improvements.

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Program Element: #23731A

Title: Surface-to-Air Missile HAWK/HAWK Improvement Program (SAM HAWK/HWP)

DOD Mission Area: #214 — Ground-Based Antiair and Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement, Army:						
Funds (current requirements)*	4700	4000	9200	9300	To Be Determined	To Be Determined
Quantities Missiles/General Support Equipment Sets (current requirements)	197/0	0/0	0/0	0/0	0/0	5328/98**
Military Construction, Army:						
Funds (current requirements)	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -	1300

*Funds shown are for the procurement of replacement rocket motors to support the missile reliability and restoration program. After approximately ten years of field life, IHAWK missiles are returned to Depot for change-out of deteriorated components. The funds required for "Additional To Completion" are to be determined during early CY 1983. On 20 January 1982, the Army decided to retain a minimum IHAWK force indefinitely. The need for additional rocket motors to support this indefinite extension is under evaluation.

**US Army procurement of all required ground systems and missiles was accomplished in prior years. Funding identified in FY 1982 through completion is only for replacement rocket motors.

E. (U) RELATED ACTIVITIES: The US Marine Corps is actively participating in the HAWK Improvement Program. Program coordination is accomplished by exchange of technical reports and joint attendance at scientific meetings and program reviews. The Identification Friend or Foe (IFF) System (AN/TPX-46) for HAWK is part of a National Defense Program (Program Element #64708A, Project #D630 (IFF Equipment)). The NATO HAWK Consortium, under the HAWK European Limited Improvement Agreement, contracted directly with US and European industry to convert their

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Program Element: #23731A

Title: Surface-to-Air Missile HAWK/HAWK Improvement
Program (SAM HAWK/HIP)

DOD Mission Area: #214 — Ground-Based Antiair and
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

HAWK assets to the Improved System. NATO is continuing production of IHAWK Phase I product improvements and has expressed interest in Phases II and III. Under the US-Japan Coproduction Agreement, Japan is manufacturing Improved HAWK.

F. (U) **WORK PERFORMED BY:** The Project is managed by the US Army Missile Command (MICOM), Huntsville, AL, utilizing contractor and in-house efforts. The prime contractor is Raytheon Company, West Andover, MA. Other contractors are Westinghouse Electric Corporation, Baltimore, MD; Instrumentation Control Systems Division (ICSD), Hauppauge, NY; Northrop Corporation, Anaheim, CA; and Aerojet, Sacramento, CA. Four other contractors are involved at a level of effort of approximately \$1 million during FY 1982-1983.

G. (U) **PROJECTS LESS THAN \$10 MILLION IN FY 1984:** Not Applicable.

H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:**

1. (U) **Project:** D880 — Surface-to-Air Missiles HAWK/Hawk Improvement

a. (U) **Project Description:** In FY 1984, \$33.543 million is required to upgrade the development and testing of the missile's ability to counter the Multiple Blinking Jammer (MBJ) and continue engineering development of the Phase III PIPs. Phase III will improve IHAWK's firepower capabilities against low-altitude targets, include a new software-driven trainer for each fire unit, allow timely and accurate target data on maneuvering targets to be sent to the battalion command and control center, add additional reliability, availability, and maintainability (RAM) improvements to the tracking radar, and incorporate the necessary microprocessors and software to support the new improvements. Since all five of the Phase III PIPs are interrelated, all costs and schedules have been integrated into a single effort to insure maximum benefit.

b. (U) **Program Accomplishments and Future Efforts:**

(1) (U) **FY 1982 Accomplishments:** Design, development, and testing of the missile improvement called missile electronic countermeasures (ECM) upgrade (MEU) was completed in early FY 1982. The MEU flight test program was successfully completed during the first quarter of FY 1982 and verified that normal missile guidance had not been degraded by the incorporation of MEU. Out of six modified missiles flown, five were direct hits and one was a close miss. Development continued on a second missile modification called the Multiple Blinking Jammer (MBJ). The MBJ design effort began in FY 1981. In the Phase II area, the Engineering Change Proposal (ECP) for the optical tracking improvement was approved in July 1982 after successful completion of its reliability and performance test program. Due to the unavailability of adequate production-level hardware,

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Program Element: #23731A

Title: Surface-to-Air Missile HAWK/HAWK Improvement Program (SAM HAWK/HIP)

DOD Mission Area: #214 -- Ground-Based Antiair and Tactical Missile Defense

Budget Activity: #4 -- Tactical Programs

the start of production testing on the other Phase II improvement, called High Power Illuminator (HPI) Reliability, Availability, and Maintainability (RAM), was slipped from late FY 1982 to early FY 1983. The initial development contract for the Phase III product improvements was awarded in April 1982.

(2) (U) FY 1983 Program: Development of the MBJ improvement will continue in FY 1983 with testing of the engineering development hardware scheduled to be completed in August 1983. From 15 October 1982 to 25 March 1983, Government acceptance testing of the Phase II HPI RAM improvement will be conducted. If successful, a production contract will be awarded in May 1983. Phase III engineering development hardware will be installed in two IHAWK Assault Fire Units (AFUs) and testing initiated in January 1983. Testing will continue throughout the remainder of FY 1983. A new feature will be added to Phase III in FY 1983. A product improvement called Collective Protection Equipment (CPE) will be integrated with the other Phase III modifications to provide nuclear, biological, and chemical attack protection for each IHAWK fire unit command post. A development contract for CPE is planned for June 1983. In FY 1983, the Army will decide what evolutionary changes to IHAWK beyond Phase III are required.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: The Multiple Blinking Jammer (MBJ) flight test program is to be completed in the first quarter of FY 1984. Ten preproduction modified missiles with MBJ kits will be flown against the threat to verify flight performance. If successful, a production contract will be awarded in February 1984. Fabrication of Phase III preproduction hardware will be completed in the first quarter of FY 1984. Three IHAWK AFUs will be modified and undergo testing. The major research, development, test, and evaluation effort of FY 1984 is the Phase III coordinated development test planned for July to October 1984. Design and development of the CPE modification will continue in FY 1984.

(4) (U) Program to Completion: Conduct verification testing of MBJ and Phase III production hardware. Completion dates are December 1985 for MBJ and March 1987 for Phase III. If testing is successful, fielding of these modifications will commence in Europe and the United States. Work will continue on the design and development of evolutionary changes beyond Phase III as required.

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Program Element: #23731A

Title: Surface-to-Air Missile HAWK/HAWK Improvement Program (SAM HAWK/HIP)

DOD Mission Area: #214 — Ground-Based Anti-air and Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
Engineering Development Contract Awarded (Basic HAWK System)	Nov 1964	Nov 1964
Initial Operational Capability (Improved HAWK System)	Nov 1972	Nov 1972
Phase I PIP Development Contract	Jan 1975	Not Shown
Phase I Fielding	Apr 1979-Nov 1981	Not Shown
Phase II PIP Development Contract	Jan 1979	Not Shown
Phase II Fielding	Jul 1983-Sep 1985	Not Shown
MEU Development Contract	Dec 1978	Not Shown
MEU Fielding	Jun 1983-Aug 1985	Not Shown
MBJ Development Contract	May 1981	Not Shown
MBJ Fielding	Feb 1986-Oct 1987	Not Shown
Phase III PIP Development Contract	Apr 1982	Not Shown
Phase III Fielding	May 1987-Nov 1988	Not Shown
CPE Development Contract	Jun 1983	Not Shown
CPE Fielding	May 1987-Nov 1988	Not Shown

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #23735A

Title: Combat Vehicle Improvement Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	29395	50152	64390	82589	134009	376535
D330	M1E1 Block Improvement Program	25168	41743	36323	39198	119890	278322
D332	Fighting Vehicle Improvements	4227	4409	10319	13148	1226	33329
D341	105mm Tank Gun Enhancement	- 0 -	4000	12665	22653	9103	48421
D342	105mm Armor-Piercing Cartridge PIP	- 0 -	- 0 -	5083	7590	3790	16463

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The acceleration of technology and the rapid pace of Soviet modernization efforts require an evolutionary improvement program to maintain the combat advantage of the M2 Infantry/M3 Cavalry Fighting Vehicles (IFV/CFV) and M1 Abrams and M80 Series Tanks over future Soviet armor. This program provides for early initiation of planned operational performance and reliability, availability, maintainability, and durability (RAM-D) improvements beyond the original performance requirements, which are responsive to anticipated threat changes and capitalize on technology opportunities.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	29395	50152	64390	216598	376535
Funds (as shown in FY 1983 submission)	29395	48785	49837	Continuing	Not Applicable

FY 1983 and FY 1984 increases are due to two new starts (Projects D341 and D342) and transfer of \$3.018 million from Program Element #64616 for Fighting Vehicle Systems Energy Hardening. An increase of \$4 million in FY 1983 for proposed 105 MM gun enhancement reprogramming was partially offset by a \$500 thousand reduction for Compartmented Programs in project D330.

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Program Element: #23735A

Title: Combat Vehicle Improvement Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Weapons and Tracked Combat Vehicles, Army Funds (current require- ments)	- 0 -	41000	50000	94600	646200	831900

E. (U) RELATED ACTIVITIES: Related, but nonduplicatory, Army activities being conducted are: Program Element #64601 (25mm Ammo PIPs); Program Element #64616A (Bradley Fighting Vehicle Systems (BFVS)); Program Element #64630A (M1E1 Development Program); Program Element #62601A (Tank and Automotive Technology); Program Element #63602A (Advanced Land Mobility Systems Concepts); Program Element #64725A (Collective Protective Material); Program Element #63631, Project #D014 (Combat Vehicle Turret and Chassis); Program Element #63633 (Long-Rod Penetrators).

F. (U) WORK PERFORMED BY: In-house efforts on this program are accomplished by the Project Managers for M1, BFVS, and M60 tanks, Warren, MI, and Project Manager for Tank Main Armament Systems, Dover, NJ; US Army Electronics Research and Development Command; Night Vision and Electro-Optics Laboratory, Fort Belvoir, VA; Chemical Systems Laboratory, Aberdeen Proving Ground, MD; Army Materials and Mechanics Research Center, Watertown, MA; Natick Laboratories, Natick, MA; Tank-Automotive Command, Warren, MI; and US Army Armament Research and Development Command, Dover, NJ. Major contractors are General Dynamics, Land Systems Division, Warren, MI; Hughes Aircraft Company, Culver City, CA; Teledyne Continental, Muskegan, MI; Texas Instruments, Dallas, TX; Minneapolis Honeywell, St. Petersburg, FL; and FMC Corporation, San Jose, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D342 — 105mm Armor-Piercing Cartridge Product Improvement Program (NEW START): The objective is to improve the armor penetration of the XM833E1 Kinetic Energy round by reducing the weight of the sabot and improving the efficiency of the propellant. This improved round will be capable of being fired from either the standard M68 105mm tank gun or from the M68 with a longer gun tube resulting from project D341 in this program element. FY 1984 Planned Program: Fabricate and evaluate candidate sabot designs and materials. Select design and material that will result in greatest performance improvement. Procure material for test quantities of XM833E1 penetrator cases. Program to Completion: Produce and test fire alternate propellants. Manufacture and test selected sabot design and materials. Complete producibility, engineering, and planning (PEP) for penetrator, sabot and metal parts for projectile. Qualify XM833E1 for standard

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Program Element: #22735A

Title: Combat Vehicle Improvement Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

and long-tube 105mm gun. Complete Government qualification testing and type classify XM833E1 in FY 1986. This technology will be applicable to the upgrade of other size ammunition for use by some tanks and recoilless rifles remaining in the US active and reserve component inventory.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: D330 — M1E1 Block Improvement Program

a. (U) Project Description: Although the M1 incorporates significant advances in crew protection, firepower, and mobility, it was designed with growth potential in mind and can be adapted by evolutionary improvements to sustain its combat advantage and reduce its logistic burden. The M1E1 Block Improvement Program (BIP) provides for timely initiation of improvements which will be responsive to threat changes and which capitalize on technological opportunities. The BIP will introduce time-phased product improvements to the production line in groups called "blocks" to minimize production costs while providing effective configuration control. Three packages are currently planned for introduction into production. The FY 1985 package (Block #1) consists of a Hybrid Nuclear Biological, and Chemical (NBC) (overpressure) system, upgraded armor, weight reduction, and suspension/final drive upgrade. The FY 1987 package (Block #2) concentrates on an improved commander's weapon station with new independent commander's and driver's thermal viewers, heading reference system, improved rangefinder, fast refuel capability and an enhanced smoke system. Block #3 contains signature suppression improvements, ballistic overhead protection, an automatic muzzle reference system, and improved ability to engage evasive targets. These packages will significantly enhance the M1's survivability, fightability, and overall combat effectiveness on the battlefield. Retrofit of improvements to vehicles in the field will also be controlled in packages to maintain cost and configuration control and minimize Integrated Logistics Support (ILS) problems. The engineering design developed under this project will apply to retrofit of improvements as well as introduction into M1E1 production.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments:

a. (U) Nuclear, Biological, and Chemical (NBC) Improvements Program: Initiated contract in FY 1981 for development of inertial dust separator, installation of chemical agent alarm, and improved materials resistant to decontaminating agents. Tested inertial dust separator, chemical agent alarm, and hybrid system/crew cooling. Initiated development of decontaminant-resistant materials. Developed engineering design changes to integrate NBC systems into armor envelope of vehicle. User evaluation developed requirement for crew cooling to reduce effects of heat stress.

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Program Element: #23735A

Title: Combat Vehicle Improvement Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

b (U) **Auxiliary Power Unit (APU):** Provides an on-board electrical power source other than the main engine. This enhances the tank's silent watch capability, reduces fuel consumption by approximately 1000 gallons per year in peacetime and aids starting the main turbine engine at temperatures as low as -65°F. One unit was tested on an M1 at the Arctic Test Center; five units were delivered for FY 1982 vehicle testing. Subsequent evaluation of the need for the APU by the Armor Center resulted in lowering the priority for the APU because the space required to install the APU displaced more fuel than the APU was estimated to save during combat. The APU is intended for later introduction if a redesign of the unit will result in a lower space claim to allow a fuel economy advantage.

c (U) **Ballistic Armor Improvements:** Provides for upgraded protection to meet Warsaw Pact weapon and munition improvements. Initiated integration and testing of armor improvements.

d (U) **Weight Reduction:** Offsets weight growth due to Hybrid NBC System, improved armor, and the 120mm gun. Minimum weight reduction goal is .75 tons and will be achieved through changes to the production process and redesign of selected low-risk components. Revision of specifications for purchase of armor plate has resulted in a 0.3 ton weight reduction. *Weighing and matching heavy turrets with light hulls* and vice versa to reduce variances in total vehicle weights did not provide sufficient favorable results to be continued.

e (U) **Suspension and Final Drive Upgrade:** These improvements are necessary to maintain RAM-D and maneuverability performance under the increased weight of the improved armor and the 120mm gun. Engineering design evaluated to determine specific changes required. M1E1 pilot vehicles (120-4 and 120-5) have changes applied for evaluation in FY 1983.

f (U) **Initiate M1 systems integration engineering efforts for improvement capabilities funded in FY 1981, and fund fabrication and installation of improvements on prototype M1E1 Tanks. Begin planning effort for Block 2 improvements.**

(2) (U) **FY 1983 Program:** Continue system integration of Block 1 Improvements into M1E1. Begin development test II (DT II) of the M1E1. Initiate development of Block 2 including:

a (U) **Commander's Weapon Station and Thermal Viewer:** Provide greater visibility enhancing command and control under "dirty battlefield conditions." Initiate contract for delivery of hardware for FY 1983 testing.

b (U) **Driver's Thermal Viewer:** Provide for greater visibility and target acquisition on the "dirty battlefield" and/or during night operations. Conduct installation check test using advanced development prototype provided by the Night Vision and Electro-Optical Laboratory.

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Program Element: #23735A

Title: Combat Vehicle Improvement Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

c (U) Improved Rangefinder, Low Profile Antenna, and SINGARS Intercom: Begin RDTE for an Improved Rangefinder, survivable Low profile Antenna, and SINGARS Intercom.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: FY 1984 is the critical year in bringing the M1E1 to production readiness by 4Q FY 1985. Development work and integration of Block 1 improvements will be completed. The final TDP (technical data package) will be accepted. Technical manuals will be validated and verified. There will be an agent test of the NBC system at Dugway Proving Grounds, UT, as well as a 120mm gun/breech interchangeability test (US and FRG). In October (1Q FY 1984), OT II will begin with four M1E1's (one platoon) at Fort Hood, TX. Development work on Block 2 improvements will continue. Driver's thermal viewer will undergo DT I.

(4) (U) Program to Completion: Integration and testing of these and future product improvements will be continued to ensure M1 Series tanks retain their combat advantage over Soviet armor.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
Block 1		
M1E1 DT/OT II Complete	4Q FY 1982	4Q FY 1984
Production Decision	4Q FY 1984	4Q FY 1984
First Production Delivery	4Q FY 1985	4Q FY 1985
Block 2 Project Initiation	FY 1983	FY 1983
First Production Delivery	FY 1988	FY 1988
Block 3 Project Initiation	FY 1985	FY 1985
First Production Delivery	TBD	TBD

2. (U) Project: D332 — Fighting Vehicle Improvements

a. (U) Project Description: The purpose of this project is to enhance the survivability of the M2/M3 by providing additional protection against the effects of nuclear and chemical weapons. This project will also improve the scout capabilities of the M3 by developing a modified vehicle cargo hatch to provide greater visibility to the sides and rear of the vehicle.

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Program Element: #23735A

Title: Combat Vehicle Improvement Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Contracts were awarded to determine what level of chemical and directed energy protection is most appropriate for the M2/M3. Both technical and cost factors are being considered. Funds were provided to the Tank-Automotive Command Research and Development Laboratory and the M2/M3 prime contractor to develop prototype modification to the M3 cargo hatch to provide increased visibility and modification to the turret safety interlock switch.

(2) (U) FY 1983 Program: The M2/M3 chemical and energy hardening studies will be completed in 1983. A review will be held to consider the study results and to provide direction for FY 1984 implementation of the energy hardening recommendations. Design and testing of the M3 cargo hatch modification will also be completed in 1983.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: The engineering efforts required to implement the M2/M3 energy hardening recommendations will be initiated in FY 1984. These efforts will entail hardening of vehicle electrical systems through redesign of circuits, replacement of components, and the addition of other forms of shielding.

(4) (U) Program to Completion: The completion date of the M2/M3 energy hardening effort will be determined after the review of the FY 1983 study results. The duration of the effort will be determined by the magnitude of the work required to implement the decisions of the review board.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
NBC Protection System Study Initiated	2Q FY 1982	2Q FY 1982
Chemical/Energy Hardening Studies Initiated	4Q FY 1982	1 Not Shown
Chemical/Energy Hardening Studies Review	4Q FY 1983	1 Not Shown
Initiate Energy Hardening Implementation Program	1Q FY 1984	1 Not Shown

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Program Element: #23738A

Title: Combat Vehicle Improvement Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
NBC Protection System Production Decision	2Q FY 1986	2Q FY 1986
First Production Delivery	3Q FY 1987	3Q FY 1987

¹ Milestone changes from FY 1983 submission are due to reprogramming of the Energy Hardening Product Improvement from PE 64616A (Bradley Fighting Vehicle Systems (BFVS)).

3. (U) Project: D341 — 105mm Tank Gun Enhancement

a. (U) Project Description: The objective of this project is to provide improved antitank capability of tanks with 105mm tank guns which are already fielded with US Active Reserve, and National Guard Units. The tasks to be accomplished will be: developing a longer tube for the M68 105mm tank gun; determining the optimum tube length that will sufficiently increase projectile velocity but will be operationally acceptable to the user community; and developing engineering design necessary to integrate this longer cannon and improved XM833 Kinetic Energy round (Project #0342, this program element) into the M1 and M60 tanks. The technology developed in this project may also be applicable to the upgrade of other size tank guns still used by some active and reserve component US units.

b. (U) Program Accomplishments and Future Efforts:

- (1) (U) FY 1982 Accomplishments: Not Applicable.
- (2) (U) FY 1983 Program: Assuming successful reprogramming of \$4 million into Project #D341, the developer will begin developing an engineering design to integrate the longer tube into M1 and M60 series tanks. Prototype tubes will be forged and provided to tank system program managers so they can determine weight and balance for integration. Producibility engineering and planning (PEP) will be initiated.
- (3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Continue integration design and PEP activity. Conduct contractor test of tanks with guns integrated.

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Program Element: #23736A

Title: Combat Vehicle Improvement Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

(4) (U) Program to Completion: Complete integration design. Qualify gun and improved XM833 ammunition. Type classify gun in 4Q FY 1985. Begin production of sufficient guns and ammunition for Government qualification testing. Begin full production of longer tube and hardware retrofit kits to allow "up-gun" of 105mm tank fleet to begin in FY 1987.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
105mm Enhancement Project Initiated	2Q FY 1983	Not Shown
Type Classify M24 Gun Tube	FY 1985	Not Shown
Type Classify XM833E1	FY 1986	Not Shown
Begin Retrofit	FY 1987	Not Shown

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #23740A

Title: Maneuver Control System

DOD Mission Area: #351 — Land Warfare

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	14075	14905	9528	9555	Continuing	Not Applicable
D484	Maneuver Control System	14075	14905	9528	9555	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Maneuver Control System fulfills an urgent need for automated command and control of battlefield operations from echelons of corps through battalion. It is needed to provide the commander the improved command and control he needs to fight more effectively on the modern battlefield where he is likely to be outgunned and outnumbered. This is achieved by providing accurate, up-to-date information, thereby permitting quicker decisions allowing more rapid application of firepower and maneuver. The system serves the commander and his G3/S3 operations staff as the principal command and control system. The system is oriented around a data base that provides decision support information and functional tools in both text and map graphics. When the decision is made as to a course of action, the Maneuver Control System provides automated support in the preparation and distribution of implementing orders, as well as reports back up the chain of command to facilitate monitoring the execution. The Maneuver Control System reports, in turn, automatically update the data base. The key feature of this program is its evolutionary acquisition and implementation beginning with an FY 1981 initial maneuver control capability in Europe and expanding in preplanned, time-phased steps to a full Maneuver Control System by the late 1980s. Preplanned product improvements enable the system to maintain state-of-the-art capabilities concurrent with providing equipment to the field.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	14075	14905	9528	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	14825	14947	9858	Continuing	Not Applicable

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Program Element: #23740A

Title: Maneuver Control System

DOD Mission Area: #351 — Land Warfare

Budget Activity: #4 — Tactical Programs

Reduction of \$750 thousand in the FY 1982 funding level is a result of reprogramming to higher priority Army requirements. The funding decrease of \$42 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTEA Appropriation. The reduction of \$30 thousand in FY 1984 funding level resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE program.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement Army Funds (Current Require- ments) ¹	N/A	26000	16800	45400	Continuing	Not Applicable
Quantities ²						
Tactical Computer Sys- tem	N/A	9	3	17	Continuing	Not Applicable
Analyst Console	N/A	2	3	3	Continuing	Not Applicable
Tactical Computer Ter- minal	N/A	15	12	34	Continuing	Not Applicable

¹ The funds are for ADP hardware devices including production engineering for deploying the Maneuver Control System beginning in FY 1986. FY 1983 through FY 1985 procurements field the MCS to the VII Corps and will complement devices previously introduced.

² These quantities are derived from the dollars available and will eventually support the Authorized Acquisition.

E. (U) RELATED ACTIVITIES: Program Element #64727A: Tactical Computer System/Tactical Computer Terminal (TCS/TCT). This project provides the generic hardware used within the maneuver control element and does not duplicate any efforts conducted in the Maneuver Control System, Program Element #64712A. System Engineering for Tactical C3 Systems: This program provides resources for implementation of intra-Army, joint, and international interoperability functions. Duplication of efforts within the Communications-Electronics Command (CECOM) is avoided through correspondence and meetings between project managers and the Center for System Engineering and Integration (CENSEI) which has overall systems engineering responsibility.

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Program Element: #23740A

Title: Maneuver Control System

DOD Mission Area: #351 — Land Warfare

Budget Activity: #4 — Tactical Programs

F. (U) WORK PERFORMED BY: Project Manager, Operations Tactical Data System (OPTADS), US Army Communications-Electronics Command (CECOM), Fort Monmouth, NJ. Ford Aerospace and Communications Corporation was selected for the full Maneuver Control System evolutionary development effort.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D484 — Maneuver Control System: Emphasis in FY 1984 continues to be evolution of the initial Maneuver Control capability with preplanned, time-phased improvements. Feedback from this effort is being used to implement, test, and evaluate new functional Maneuver Control capabilities. Improvements to user applications will include initial data base capabilities, additional protocols, summary reports, and security management. A contract for the full Maneuver Control System evolutionary development effort was awarded in July 1982. Upon successful completion of ASARC III in the 2Q FY 1983, contract awards will be made for procurement of initial Maneuver Control Systems and continued evolutionary acquisition to enable progression from initial capabilities to a mature system. The program provides for infusion of new technology, as necessary, to preclude obsolescence and to respond to user feedback to insure the most responsive applications are available. In FY 1984, software development will focus on the full data base implementation while beginning integration of those force-level interoperability functions specified in the Army's Battlefield Interface Concept (ABIC). Contractor effort will continue prototype maintenance and support.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #23741A

Title: Product Improved Vulcan Air Defense System
(Interim Lightweight Air Defense System)

DOD Mission Area: #214 — Ground-Based Antiair and
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	- 0 -	5320	*	To Be Determined	To Be Determined
D698	Product-Improved VULCAN Air Defense System	- 0 -	- 0 -	5320	*	To Be Determined	To Be Determined

*Outyear RDTE funding requirement will depend on evolving LADS/PIVADS program definition.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Organic air defense is required by our airborne, air assault, and light infantry divisions to allow these rapid deployment forces to operate independently anywhere in the world. Short-range, low-altitude air defense is currently provided by CHAPARRAL, VULCAN, and REDEYE. REDEYE is being replaced by STINGER. To replace VULCAN, an objective Lightweight Air Defense System (LADS) will be developed from testing in the early 1990s. To meet the near-term requirements of the 9th Infantry Division and the light, rapid deployment force, an interim system, Product-Improved VULCAN System (PIVADS), or a PIVADS Hybrid (PIVADS with STINGER missiles), will be developed to meet an FY 1986 Initial Operational Capability.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands) Not Applicable. No FY 1983 submission was made.

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Program Element: #23741A

Title: Product Improved Vulcan Air Defense System
(Interim Lightweight Air Defense System)

DOD Mission Area: #214 — Ground-Based Antiair and
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement, Army Funds (current require- ments)	- 0 -	- 0 -	9300	33700	Continuing	Not Applicable
Quantities (current re- quirements)	- 0 -	- 0 -	39	241*	Continuing	Not Applicable

The \$9.3 million will be used to begin the procurement of PIVADS modification kits for the VULCAN Air Defense Systems (VADS). A total of 221 modification kits will be required to all towed VADS to support light forces. A total of 288 modification kits will be required for self-propelled VADS for the National Guard.

* Quantity depends on program definition.

E. (U) RELATED ACTIVITIES: STINGER (Program Element 64306A) and DIVAD (Program Element 64131A) are related programs. Currently, there is no duplication of effort within the Army between these programs and the PIVADS/LADS program. Should it be determined that LADS will be a derivative of one of these systems, it is anticipated the LADS program would become a project under the control and management of the parent system Project Management Office.

F. (U) WORK PERFORMED BY: Development contract awarded to Lockheed Electronics Company, Inc., Plainfield, NJ. The Armament Readiness Command, Rock Island, IL, is the in-house developer.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D698 — Product-Improved VULCAN Air Defense System (NEW START): The VULCAN Air Defense System (VADS) is inadequate to provide air defense protection for our light forces. To provide the improvement in air defense protection required by the light forces, the Army will develop an objective Lightweight Air Defense System (LADS). The Army program will result in an Initial Operational Capability (IOC) for LADS in the early 1990s. To meet the near-term requirements of the 9th Infantry Division and light, rapid deployment forces, an interim system, PIVADS, will be developed to meet an FY 1986 IOC. Towed PIVADS will be provided to light divisions in the National Guard

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DESCRIPTIVE SUMMARIES OF THE RESEARCH DEVELOPMENT TEST
& EVALUATION ARMY..(U) DEPUTY CHIEF OF STAFF FOR
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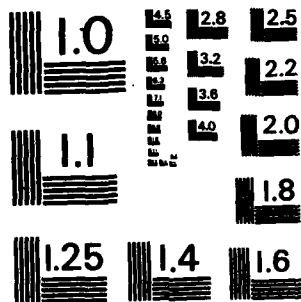
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Program Element: #23741A

Title: Product Improved Vulcan Air Defense System
(Interim Lightweight Air Defense System)

DOD Mission Area: #214 — Ground-Based AntiAir and
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

when the objective LADS is fielded in the active force. FY 1982 accomplishments: A development contract was awarded to Lockheed in September 1982 to develop PIVADS modifications for the self-propelled VULCAN, which is slated for the National Guard. No FY 1983 funding for PIVADS was requested. FY 1984 funds are required to develop PIVADS modifications for towed VULCAN, and to begin the procurement of the modification kits. Program to completion: the PIVADS/PIVADS Hybrid development effort, initiated with FY 1981 funds, will be completed with FY 1986 funds.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #23743A

Title: 155mm Self-Propelled Howitzer Improvement Program
(formerly Division Support Weapon System)

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2032	8916	64497	131584	Continuing	Not Applicable
D008	155mm Self-Propelled Howitzer Improvement	2032	8916	64497	131584	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The M109 155mm Self-Propelled Artillery Weapon System provides indirect fire support to the maneuver forces of the armored and mechanized divisions/brigades. Indirect fire support provided by this system includes the destruction, neutralization, and suppression of targets within the maneuver commander's area of responsibility. The purpose of the 155mm Self-Propelled Howitzer System RDTE Improvement Program is to ensure that the Army maintains a responsive, survivable, reliable, and lethal 155mm Self-Propelled Howitzer System that will provide close indirect fire support to maneuver elements of heavy divisions/brigades through the 1990s and beyond. A Mission Element Need Statement (MENS), identifying deficiencies in the areas of reliability-availability-maintainability, survivability, terminal effects, and responsiveness, was approved by the Secretary of Defense in December 1981.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2032	8916	64497	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	2032	8941	79127	Continuing	Not Applicable

The decreases in FY 1983 is due to pro rata application of general Congressional reductions to the RDTE,A appropriation. Reduction in FY 1984 is a result of realignment to other high priority Army requirements. In previous years, funding for this program was in Program Element 63629A, Project D008, Division Support Weapon System (DSWS).

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Program Element: #23743A

Title: 155mm Self-Propelled Howitzer Improvement Program
(formerly Division Support Weapon System)

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The following are related activities. These projects are being monitored to ensure that no duplication is taking place and that the system is fully compatible.

- 62803 — Large Caliber and Nuclear Technology;
- 63306 — Terminally Guided Projectiles;
- 64603 — Nuclear Munitions, Improved 155mm Nuclear Projectile;
- 63628 — Field Artillery Ammunition Development, Modular Charges, Automatic Set Fuzes; Sense and Destroy Armor
- 64614 — FA Weapons and Ammunition, 155mm;
- 64621 — Copperhead;
- 64631 — Field Artillery Ammunition, Sense and Destroy Armor (SARDAM) Munition;
- 64828 — Indirect Fire Training Munitions;
- 62746 — Tactical Automatic Data Processing Technology;
- 23726 — Advanced Field Artillery Tactical Data Systems;
- 63723 — Command and Control, Military Computer Family;
- 64727 — Command and Control, Military Computer Family;
- 63713 — ADDS — Army Data Distribution Systems
- 64702 — Joint Tactical Information Distribution Systems;
- 64751 — Single Integrated Channel Ground and Air Radio System (SINCGARS) Engineering Development;
- 64779 — Joint Integrated Tactical Command and Control;
- 64777 — Meteorological Equipment Systems, Meteorological/Data System;
- 63621 — Combat Vehicle Propulsion Systems;
- 63626 — Advanced Diesel Systems;
- 63631 — Combat Vehicle Turret and Chassis.

F. (U) WORK PERFORMED BY: Contracts for system concept studies were executed by Ford, Machinery and Chemical Corp (FMC), San Jose, CA, Pacific Car and Foundry Corporation, Renton, WA, and Norden Systems, Norwalk, CT, as prime contractors. In-house developing organizations participating in the program are: US Army Armament Materiel Readiness Command, US Army Armament Research and Development Command, US Army Tank-Automotive Command, US Army Communications Electronics Command

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Program Element: #23743A

Title: 155mm Self-Propelled Howitzer Improvement Program
(formerly Division Support Weapon System)

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: D008 — 155mm Self-Propelled Howitzer Improvement Program

a. (U) Project Description: The preferred approach to maintaining an effective 155mm Self-Propelled Howitzer System is through near-term improvement of the M109 155mm Self-Propelled Howitzer System that now performs the close support mission for heavy divisions and brigades. The Special Study Group, formed at Ft Sill, Oklahoma, in May 1982, is now considering improvement alternatives and is preparing for an Army Systems Acquisition Review Council (ASARC) I Review in May 1983. M109 improvements being considered include an automatic projectile loader; a new or improved recoil system that would allow installation of the M199 Cannon that is now on the M198 Towed Howitzer and would provide a maximum range capability of 30km; and a new or improved engine. Alternatives for new system development are being considered by the Special Study Group and will be presented to the ASARC in May 1983, although the probability for initiating a development program for a M109 replacement in the near-term is rated as being low; presentation of new system alternatives will provide a complete picture to the ASARC. Timing for a future new development will be dependent upon the extent of the improvements that can be made to the M109.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Special Study Group was formed at Fort Sill, OK, in May 1982. Work in FY 1982 concentrated on the test and analysis of the M109 chassis as well as concept refinement, baseline cost estimates, and report development required for the Army Systems Acquisition Review Council (ASARC) I decision scheduled for May 1983. Development of functional system performance specifications, acquisition strategies, and statements of work required for competitive procurement packages for validation phase development was initiated. Fabrication of mockups and test fixtures for selected components was also initiated.

(2) (U) FY 1983 Program: Complete M109 chassis tests and analyses. Complete preparation of analyses and reports required for an Army/Defense Systems Acquisition Review Council third quarter, FY 1983 selection. Conduct ASARC in the third quarter, FY 1983. Complete preparation and release of a competitive procurement package by 3Q FY 1983. Complete fabrication of mockups and test fixtures of selected components such as an automatic projectile loader and a new recoil mechanism.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Source selection activities will be completed, and contractors will be awarded validation phase development contracts in the second quarter, FY 1984. The winning contractor(s) will develop prototype vehicles.

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Program Element: #23743A

Title: 155mm Self-Propelled Howitzer Improvement Program
(formerly Division Support Weapon System)

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

(4) (U) Program to Completion: Prototype vehicles will be tested to demonstrate their capability to meet required performance specifications. The product improvement schedule projects a production decision in the first quarter, FY 1988 and initial operational capability in the first quarter, FY 1990.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
ASARC I	May 1983	2Q FY 1983
Validation Phase Contract Award	2Q FY 1984	2Q FY 1984

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Program Element: #23743A

Title: 155mm Self-Propelled Howitzer Improvement Program
(formerly Division Support Weapon System)

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

I. (U) TEST AND EVALUATION DATA:

1. (U) Development Test and Evaluation:

a. (U) The 155mm Self-Propelled Howitzer System RDTE Improvement Program is currently in the Concept Exploration Phase with Army Systems Acquisition Review Council I decision planned for May 1983. Action has been taken to formalize a Test Integration Working Group to plan Development Test and Evaluation (DT&E) activities, with a Demonstration and Validation Phase planned for FY 1983-1987.

b. (U) Although most of the DT&E activities will take place after ASARC/DSARC I, some preliminary DT&E activities have necessarily been conducted during the conceptual phase to quantify risks involved in some specific areas of concern. Of special interest is the alternative of making major development improvements to the existing M109 Self-Propelled Howitzer (SPH). The impact of weight growth on chassis durability is being evaluated by a 4,000-mile road test of two heavily weighted M109 Howitzers. The heaviest M109, weighted to 64,500 pounds, 9,500 pounds above the present M109 weight of 55,000 pounds, began testing in July 1982. Preliminary results indicate some problem areas to include: shock absorbers worn out at 700 miles; idler housing bolts sheared; excessive track pad wear; difficulty in handling vehicle on level cross-country; rear bottom of vehicle and idler wheel impact on level cross-country; possible cracks in hull; brakes inadequate on downward slopes. Improvements to correct these problems are being considered from both a short-range (test continuation) and long-range (developmental improvements during the demonstration/validation phase) view. Previous results from another vehicle upweighted to 60,480 pounds have not indicated similar problems, and limits for allowable weight growth may be established based on these tests. Additionally, an increased horsepower engine is undergoing laboratory testing for compatibility with NATO high-sulphur fuels. No significant problems have surfaced in testing the engine.

c. (U) Although an automatic loader is not being tested during the Concept Exploration Phase brassboard items will be demonstrated and evaluated along with full-scale mockups. There are considerable technical data and foreign system information available to support design concept feasibility. To address concerns of spacial layout and human factors, mockups of autoloader systems are being prepared and will be available for analysis before the ASARC. These evaluations will help clarify the choices between development alternatives.

d. (U) Differences in performance of the upweighted M109 emphasize the concerns over the weight growth for current system improvement alternatives. Current actions are to determine if chassis design fixes can be implemented to eliminate or minimize the weight growth related problems. Additional weight growth analysis of components versus system requirements continues and is the reason that three different levels of M109 SPH improvement have been defined for the formal Cost and Operational Effectiveness Analysis.

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Program Element: #23743A

Title: 155mm Self-Propelled Howitzer Improvement Program
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DOD Mission Area: #212 — Indirect Fire Support

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e. (U) Demonstration of specific technical performance levels will be an action of the development and validation phase during FY 1983 to FY 1987. Currently, during the concept phase, the program is managed by a Special Study Group located at Ft Sill, OK, and assisted by the Project Manager, Cannon Artillery Weapons Systems (PM-CAWS) at Dover, NJ. After ASARC/DSARC, a DARCOM PM will be designated. Contractor support for concept definition has been provided by Pacific Car and Foundry Company, FMC Corporation, and Norden Systems Division of United Technologies. Norden has provided specific assistance in defining the 4,000-mile road test program. After DSARC, new competitive solicitations will be issued, and system development contractors will be selected. The activity responsible for DT&E will be the DARCOM PM. Independent evaluation will be by the Operational and Test Evaluation Agency (OTEA) for operational testing and the Army Materiel Systems Analysis Activity (AMSAA) for development testing. Operational maintenance aspects are currently under extensive study.

2. (U) Operational Test and Evaluation: Operational issues are being addressed in the concept phase by analysis rather than testing. OTEA is actively involved in planning for Operational Test I, scheduled in FY 1986 at Ft. Sill, OK.

3. (U) System Characteristics: Specific development requirements and program thresholds have not yet been established, but analysis underway will yield formal requirements and thresholds prior to ASARC I. Demonstration of compliance with requirements will take place during the D/V phase in FY 1983-1987, culminating in a DT/OT I in FY 1986-1987. Fix and retest action will be accomplished throughout the D/V phase and follow-up confirmatory testing will be conducted after the ASARC/DSARC II in FY 1987.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #23744A

Title: Aircraft Modifications

DOD Mission Area: #218 — Land Warfare Associated Air Mobility

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	- 0 -	3323	39120	179158	182481
D179	CH-47 Product Improvements (PI)	- 0 -	- 0 -	- 0 -	3125	66960	70085
D193	UH-60 Product Improvements (PI)	- 0 -	- 0 -	3323	24879	19764	48066
D423	AH-64 Product Improvements (PI)	- 0 -	- 0 -	- 0 -	11016	53314	64330

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Army has a requirement for improved helicopters capable of meeting evolving tactical doctrine, concepts, and an extensive array of both current and projected threat weapon systems. Improvements will increase operational capabilities and expand the performance, survivability, and improved avionics characteristics to provide greater support in accomplishment of helicopter missions. Use of a Block Improvement approach will enable us to incorporate technological upgrades into our proven weapon systems and will allow us to be responsive to the OSD initiatives of enhancement by Preplanned Product Improvement (P3I).

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	- 0 -	- 0 -	3323	179158	182481
Funds (as shown in FY 1983 submission)	- 0 -	1044	13450	45350	59853

This is a new program element and a new start. Last year, Project #D193, carried under Program Element #64206A, was decremented in total during authorization. The current funding for FY 1984 is \$3.323 million, a decrease from the FY 1983 Congressional Descriptive Summary reported funding level of \$13.450 million for FY 1984. The \$10 million decrement was required to fund higher priority Army projects. The remaining FY 1984 reduction of \$122 million resulted primarily from a revision of the anticipated inflation in the proposed Army RDTEA budget.

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Program Element: #23744A

Title: Aircraft Modifications

DOD Mission Area: #218 — Land Warfare Associated Air Mobility

Budget Activity: #4 — Tactical Programs

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement, Army						
Funds (current requirements)						
CH-47E(PI)	- 0 -	- 0 -	- 0 -	- 0 -	1098000	1098000
UH-60 (PI)	- 0 -	- 0 -	- 0 -	- 0 -	739000	739000

E. (U) RELATED ACTIVITIES: This program element contains no unnecessary duplication of effort within the Army or the Department of Defense. Concept and program formulation efforts have been conducted by the Directorate for Advanced Systems, Headquarters, US Army Aviation Research and Development Command, in concert with the appropriate Project Manager's Office (AVRADCOM), under Program Element #622091 (Aeronautical Technology), Project #AH76. Project personnel maintain close liaison with laboratories, other military services, industry officials, and user representatives as well as participate in Joint Working Groups. The Army Avionics Research and Development Activity, AVRADCOM, and the Research and Technology Laboratories, AVRADCOM, participate in concept formulation to insure full application of the generic technology base program to preclude duplicative efforts.

F. (U) WORK PERFORMED BY: Overall program coordination during concept formulation will be provided by the Directorate for Advanced Systems, Headquarters, AVRADCOM, St. Louis, MO, and will transfer to the pertinent Project Manager for initiation of engineering development. The UH-60A Project Manager is located in St. Louis, MO.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D193 — UH-60 Product Improvement (NEW START): This program element contains three separate projects, only one of which starts in FY 1984. Consequently, only Project D193, UH-60 Product Improvements, will be discussed. The UH-60A, Black Hawk, has already demonstrated in operational deployment that it performs to its planned reduction in maintenance, its expected operational readiness, and its intended flying ease. Operational experience has also demonstrated the Black Hawk is an excellent airframe that can be improved. Planned improvements under this project are priority user requirements. The US Army Infantry School, the proponent for the Black Hawk, has identified an operational need for the UH-60 to lift, carry, and reposition the new High Mobility Multipurpose Wheeled Vehicle (HMMWV). The UH-60 external cargo-handling system will be modified for this purpose. This change will be compatible with another improvement of adding a two-point

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Program Element: #23744A

Title: Aircraft Modifications

DOD Mission Area: #218 — Land Warfare Associated Air
Mobility

Budget Activity: #4 — Tactical Programs

suspension system to handle 12,000-pound, high-weight, low-density loads such as military vans and fuselage sections. The two-point suspension will allow the Black Hawk to double the current allowable speed using single point suspension. Another modification concerns the need to change cockpit lighting to a blue-green color to be compatible with night vision goggles. Operational experience has proven that the existing lighting interferes with the operation of night vision goggles. Further improvements are necessary to reduce the effects of sand on the Black Hawk when operating in desert environments. Kits will be developed which include a sand separator for the auxiliary power unit, covers for the instrument console, and protective means to reduce rotor blade erosion. Technology demonstrations have indicated the amount of on-board electrical wiring in aircraft can be significantly reduced by the concept of multiplexing. The vulnerability of wiring to the effects of projectile hits on aircraft would be reduced as would the cost of wiring. Black Hawk multiplexing would be accomplished to achieve these benefits as well as to reduce pilot workload. Other improvements to be considered will be electromagnetic pulse (EMP) protection, increased nuclear, biological, and chemical protection, provision for air-to-air weapons, and a flight data recorder. Specific tasks to be initiated with the FY 1984 funding will be the preliminary design work for development of an Auxiliary Power Unit particle separator for operations in desert environments and a two-point cargo suspension system to support follow-on full-scale development. This project is a new start.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #28010A

Title: Joint Tactical Communications (TRI-TAC) Program

DOD Mission Area: #345 - Tactical Communications

Budget Activity: #4 - Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	42987	43457	46766	26664	Continuing	Not Applicable
	QUANTITIES						
D104	Joint Tactical Communications (TRI-TAC) Office	7022	7313	7413	7445	Continuing	Not Applicable
D107	Mod to Army TRI-TAC Equipment	6424	5054	4849	6378	Continuing	Not Applicable
D108	Communications System Control Element	- 0** -	- 0** -	19293	- 0 -	Continuing	Not Applicable
D110	Mobile Subscriber Equipment	600	2143	- 0 -	- 0 -	- 0 -	Not Applicable
D111	Digital Group Multiplexer	2747	3181	2261	279	Continuing	Not Applicable
D114	Other Service- Assigned TRI-TAC Tasks	5083	3055	4784	10218	Continuing	Not Applicable
D116	Facility Support Element	1050	961	918	928	Continuing	Not Applicable
D117	Short-Range Wideband Radio (SRWBR) Assemblies	267	273	- 0 -	- 0 -	- 0 -	7662
D119	Modular Record Traffic Terminal (MRTT)	11028	9764	1617	- 0 -	- 0 -	34658
D172	Net Radio Interface (NRI)	406	139	198	197	Continuing	Not Applicable
D178	Joint Test Support	1212	1940	1204	1219	Continuing	Not Applicable
D222	Automatic Communications Control Office AN/TTC-39	7168	9614	4429	- 0 -	- 0 -	260314

* Quantities include 9 AN/TTC-39 Circuit switches, 7 AN/TYC-39 Message Switches, total of 549 items of DGM family (15 components), 6 AN/GRC-144 Radio Set SRWBR Modification Kits, and 3 each prototype assemblies of AN/TRC-173 Radio Terminal, AN/TRC-174 Radio Repeater, Standard SRWBR Assembly, Radio Terminal Set, AN/TRC-175, and the Modified AN/TRC-138 Radio Repeater. Other RDTE quantities represent a number of diverse items.

** Previous development effort funded by the US Air Force in PE 28010F.

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Program Element: #28010A

Title: Joint Tactical Communications (TRI-TAC) Program

DOD Mission Area: #345 — Tactical Communications

Budget Activity: #4 — Tactical Programs

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Joint Tactical Communications (TRI-TAC) Program is a Joint Service and DOD agency program to develop and field future tactical multichannel switched communications systems and equipment to satisfy the tactical communications needs of the military services by achieving interoperability between Army and other Department of Defense (DOD) telecommunications systems, providing new equipment which reflects the most recent technology, and eliminating duplication among the Service and agency systems. These systems and equipment will provide combat forces with tactical communications equipment to meet the mobility, security, reliability, and availability requirements of the modern battlefield, provide resistance to the intercept and electronic warfare threat of potential enemies, and reduce life cycle support and personnel costs. The current inventory of Army tactical multichannel switched communications systems and equipment is characterized by obsolete, manpower-intensive, predominantly manual telephone and record traffic (messages) switchboards; obsolete, low-speed, electromechanical, unreliable teletypewriters; nonsecure analog telephones; a digital, solid-state multichannel transmission system capable only of link security; and manual technical control and management facilities. Current tactical voice telephone systems are not capable of end-to-end voice security. Tactical record traffic, while secure, is slow, unreliable, and manual. The Army's implementation of equipment developed under the TRI-TAC program will provide a significant increase in capability over current systems and equipment. The Army's Integrated Tactical Communications System (INTACS) employing TRI-TAC equipment will be capable of end-to-end voice, record, and data security. TRI-TAC equipment bridges the span from the current analog equipment to digital systems. Digital systems and equipment take advantage of Large-Scale Integration (LSI) solid-state technology for increased reliability and reduced maintenance, size, weight, and power consumption; provide increased efficiency of transmission systems without increasing the number of radio systems or radio spectrum occupied; and lend themselves to the cost-effective application of voice communications security (COMSEC) and jam-resistance techniques. Both voice and record traffic switching functions will be secure, automated, and processor controlled, and telephone subscribers will have the capability of end-to-end security.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	42987	43457	48766	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	42986	47184	52515	Continuing	Not Applicable

The funding decrease of \$3727 thousand in FY 1983 is a result of the pro rata application of general Congressional reductions to the RDTE, A appropriation and the reprogramming of funds for AUTODIN replacement and the Army Data Distribution System. The net funding decrease of \$5749 thousand in FY 1984 is a result of the cancellation of the Modular Tactical Communications Center and Mobile Subscriber Equipment developments, and the transfer of the development of the Communications System Control Element from the US Air Force to the US Army.

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Program Element: #28010A

Title: Joint Tactical Communications (TRI-TAC) Program

DOD Mission Area: #345 — Tactical Communications

Budget Activity: #4 — Tactical Programs

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement, Army Funds (current require- ments)	123600	310800	373700	440000	Continuing	Not Applicable
Quantities (current re- quirements)

* Large number of diversified items.

The increase in the program in all years results from a restructuring of the program to satisfy increased requirements.

E. (U) RELATED ACTIVITIES: Related programs include other Services and National Security Agency (NSA)-assigned TRI-TAC tasks under Program Elements #28010F, 28010M, 28010N, and 33401 (Communications Security Equipment). The TRI-TAC Office monitors all of the assigned TRI-TAC programs and any Service and DOD agency-related programs to insure there is no duplication of effort.

F. (U) WORK PERFORMED BY: Overall System architecture and inter-Service coordination is performed by the Joint Tactical Communications Office (TRI-TAC), Fort Monmouth, NJ. Acquisition (development and production) of TRI-TAC equipment is performed by the tasked Service or agency as assigned by the Secretary of Defense. Current Army contractors are: GTE Sylvania, Needham Heights, MA (AN-TTC-39 Family of Switches); Raytheon Company, Sudbury, MA (Digital Group Multiplexer Family); Singer/Librascope, Glendale, CA (SST); and ITT, Nutley, NJ (SRWBR). The TRI-TAC Office, which is totally funded by the Army, has one support contractor, Planning Resources Corporation, McLean, VA. In-house developing organization for TRI-TAC tasks assigned to the Army is the US Army Communications-Electronics Command, Fort Monmouth, NJ (Project Manager, Multi-Service Communications Systems (MSCS)).

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D104 — Joint Tactical Communications (TRI-TAC) Office: This project provides funding for the operation (civilian salaries, operating expenses, and support contracts) of the Joint Tactical Communications (TRI-TAC) Office located at Fort Monmouth, NJ. The TRI-TAC Office was established by the Secretary of Defense to provide overall joint management of the TRI-TAC Program. Department of Defense (DOD) Directive 5148.7

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Program Element: #28810A

Title: Joint Tactical Communications (TRI-TAC) Program

DOD Mission Area: #345 — Tactical Communications

Budget Activity: #4 — Tactical Programs

placed the Director, TRI-TAC Office, under the staff supervision of the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (ASD(C3I)) now Deputy Under Secretary of Defense (DUSD(C3I)). During FY 1982 the TRI-TAC Office monitored the planning for the fielding of the AN/TTC-39 Circuit Switch (CS) and AN/TTC-39 Message Switch (MS); coordinated the joint activities associated with the award of production contracts for the Digital Group Multiplexers (DGM), Digital Troposcatter Radio (TROPO), and Basic Net Radio Interface Device (BNRID) and a development contract for the Communications Systems Control Element (CSCE); and held joint production reviews for the Digital Nonsecure Voice Terminal (DNVT) and Tactical Digital Facsimile (TDF). During FY 1983 the TRI-TAC Office will monitor the fielding of the CS, MS, and BNRID, and the planning for the fielding of DGM, TROPO, DNVT, and TDF; coordinate the DT/IOTE of the Unit Level Circuit Switch (ULCS), Single Subscriber Terminal (SST), Secure Digital Net Radio Interface Unit (SDNRIU), and Advanced Narrowband Digital Voice Terminal (ANDVT); and coordinate the award of a production contract for the Communications Nodal Control Element (CNCE). During FY 1984 the TRI-TAC Office will monitor the fielding of the CS, MS, DGM, and DNVT and the planning for the fielding of the TROPO and TDF; coordinate the continued development and testing of the ANDVT, CSCE, and Unit Level Message Switch; and coordinate the joint activities associated with the award of production contracts for the SST, SDNRIU, and ULCS.

2. (U) D107 — Mod to Army TRI-TAC Equipment: This project provides funding to develop interfaces and insure interoperability with emerging NATO and US systems and equipment that are scheduled for fielding after the AN/TTC-39 family of switches. During FY 1982, work was started to develop software to provide an alternate parent switch interface between the AN/TTC-39 and the AN/TTC-42 Unit Level Circuit Switch; to develop software to provide an interface capability between the AN/TTC-39 and the Communications Nodal Control Element (CNCE), the Communications Systems Control Element (CSCE), and the Advanced Narrowband Digital Voice Terminal (ANDVT); and to design software for an emergency recovery capability for the AN/TTC-39 family of switches. During FY 1983 the work initiated in FY 1982 will continue and planning for the testing and insertion of the interfaces being developed will begin. During FY 1984 the interface development will continue, planning for testing and insertion of the interfaces will be completed, and the testing will begin.

3. (U) D111 — Digital Group Multiplexer: This project provides funding for the development of the Digital Group Multiplexers (DGM) and the AN/TRC-173, AN/TRC-174, and AN/TRC-175 Transmission Assemblies. The DGM equipment consists of a family of digital multiplexers, cable drivers, group modems, and pulse restorers for use as elements of the TRI-TAC system; one or more members of the DGM family is used in or with every TRI-TAC assembly. During FY 1982, a three-year multiyear production contract was awarded to Raytheon for the DGM family of equipment; a special Fabrication Project with Tobyhanna Army Depot was started for the Transmission Assemblies; and development was started for a fiber optics modem and test unit and a Quick-Erect Antenna Mast (QEAM). During FY 1983 development of Test Program Sets (TPS) for DGM will begin; fiber optics developments will continue, and the QEAM will be tested. During FY 1984 the fiber optics and TPS efforts will continue; the first production DGM components will be delivered to other Services and the Army Signal School; and a procurement package for the follow-on DGM and Assembly production contract will be prepared, and the solicitation will be issued.

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Program Element: #28010A

Title: Joint Tactical Communications (TRI-TAC) Program

DOD Mission Area: #345 — Tactical Communications

Budget Activity: #4 — Tactical Programs

4. (U) **D114 — Other Service-Assigned TRI-TAC Tasks:** This project provides the funding for the Army to monitor the equipment in the TRI-TAC System which is developed by the other Services; it includes money for monitoring testing, preparing for Army production decisions, and developing Army-unique components associated with the other Service developments such as unique test program sets used with Army Automated Test Equipment. During FY 1982 the Air Force awarded an initial production contract (three-year multiyear) for AN/TRC-170 Troposcatter Radio (TROPO) and a development contract for the Communications System Control Element (CSCE). Development and testing continued on the Digital Non-Secure Voice Terminal (DNVT), the Tactical Digital Facsimile (TDF), and the Communications Nodal Control Element (CNCE). Development continued on the Unit Level Circuit Switch (ULCS) and Advanced Narrowband Digital Voice Terminal (ANDVT). During FY 1983 production contracts will be awarded for the TDF, DNVT, and CNCE, and testing will occur on the ULCS and ANDVT. During FY 1984 development and testing will continue for the ULCS, ANDVT, and CSCE.

5. (U) **D116 — Facility Support Element:** This project provides the funding to support the operation of the Facility Support Element (FSE) of the TRI-TAC Joint Test Organization located at Fort Huachuca, AZ. The FSE is assigned to the Army Electronics Proving Ground and is operated and maintained by a support contractor. It contains a baseline configuration of equipment which is used to support testing of all TRI-TAC-developed equipment. During FY 1982, the FSE supported testing of the CNCE, DNVT, TDF, AN/TTC-39, and AN/TYC-39. During FY 1983 the FSE will support testing of the ULCS, ANDVT, Single Subscriber Terminal (SST), and Secure Digital Net Radio Interface Unit (SDNRIU). During FY 1984, the FSE will support testing of the ANDVT, SST, ULCS, and Unit Level Message Switch (ULMS).

6. (U) **D119 — Modular Record Traffic Terminal (MRTT):** This project provides the funding to support the development of the AN/UGC-137 Single Subscriber Terminal (SST) and the Improved Message Facility (IMF).

a. (U) **AN/UGC-137 SST:** The SST is a family of tactical terminal equipment which is used by individual subscribers or in communications centers to transmit, receive, and process message traffic; it provides the capability to compose, edit, display, refile, transmit, and receive message traffic in tactical, strategic, and special intelligence communications systems. During FY 1983 the contractor completed hardware and software design, hardware fabrication, software development, and initial hardware testing. During FY 1983 the contractor will complete software development, begin contractor development testing, and deliver full-scale development models to the Government for the start of Government testing. Government testing will be completed during FY 1984, and a production contract will be awarded.

b. (U) **Improved Message Facility (IMF):** The IMF consists of product improvements of two existing Army inventory assemblages, the AN/MS-29 and AN/TSC-58. The product improvements modify the assemblages to improve their operational capability for message handling. The improvements eliminate the manual torn-tape message relay and provide semiautomatic message switching using microprocessor technology and modern peripheral equipment. The processor performs system control functions including message relay, routing, and buffering. The peripheral equipment includes an Optical Character Reader, AUTODIN mode I interface device, AN/UGC-74 communications terminals (AN/UGC-137 when available).

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Program Element: #20010A

Title: Joint Tactical Communications (TRI-TAC) Program

DOD Mission Area: #345 — Tactical Communications

Budget Activity: #4 — Tactical Programs

and new COMSEC equipment (KG-84). During FY 1982 two AN/TSC-58s were modified for demonstration and feasibility testing. A development contract was awarded for the modification of four AN/MS-29s. During FY 1983, the IMFs will undergo confidence testing at Fort Monmouth, NJ, and operational testing at Fort Gordon, GA, and a production contract will be awarded. Under a preplanned product improvement program, a competitive development contract will be awarded for the upgrade of the Processor Controller. This effort will be completed during FY 1984 and a production contract awarded to the successful competitor.

7. (U) D172 — Net Radio Interface (NRI): This project provides funding for the development and testing of Net Radio Interface units. These units allow the interface of analog and digital subscribers of the multichannel switched communication system with users of single-channel combat net radios. The project includes the Basic Net Radio Interface Device (BNRID) and the Secure Digital Net Radio Interface Unit (SDNRIU). The SDNRIU is tasked to the National Security Agency for development and the Army for testing. During FY 1982 the BNRID contract was awarded and planning was completed for the SDNRIU testing. Testing (DT II/OT II) of the SDNRIU will begin during FY 1983. Testing will be completed and the production contract will be awarded during FY 1984.

8. (U) D178 — Joint Test Support: This project provides the funding for the Army's share (35%) of the operation of the TRI-TAC Joint Test Element (JTE) located at Fort Huachuca, AZ. The Joint Test Element was established by Deputy Secretary of Defense direction to provide a permanent test facility for TRI-TAC Program equipment; it was established to ensure the interoperability, compatibility, integrated logistic supportability, operational suitability, and effectiveness of all TRI-TAC Program equipment. All Services share in its funding. During FY 1982 the JTE supported the testing of the DNV, TDF, CNCE, AN/TTC-39, and AN/TYC-39. During FY 1983 the JTE will support the testing of the SDNRIU, ANDVT, SST, ULCS and TROPO. During FY 1984 the JTE will support testing of the ANDVT, SST, ULCS, and ULMS.

9. (U) D222 — Automatic Communications Control Office, AN/TTC-39: This project provides the funding for the development of the AN/TTC-39 Program. The AN/TTC-39 Program contains a family of modular and transportable communications switches which provide secure, automatic, processor-controlled switching for tactical voice and message traffic. Components of the family are hybrid (analog and digital) circuit switches (AN/TTC-39) varying in size from 450 (300-line) to 750 terminations (600-line) and a 50-line digital message switch (AN/TYC-39). The AN/TTC-39 family replaces obsolete, predominately manual, manpower-intensive telephone central offices and obsolete, manpower-intensive, manual record traffic (message) central offices and relays. The AN/TTC-39 family provides the transition from the current inventory analog switching systems to the automatic digital TRI-TAC system. The AN/TTC-39 and AN/TYC-39 switches are in production, and the present development effort is limited to the development of software for interface with other TRI-TAC equipment; this software effort will continue through FY 1984.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

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Program Element: #28010A

Title: Joint Tactical Communications (TRI-TAC) Program

DOD Mission Area: #345 — Tactical Communications

Budget Activity: #4 — Tactical Programs

1. (U) Project: D108 — Communications System Control Element

a. (U) Project Description: This project provides the funding for the development of the Communications Systems Control Element (CSCE). The CSCE is required to exercise near-realtime control over the allocation and use of resources within its assigned portion of the deployed tactical communications network.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: This project was funded and managed by the US Air Force under Program Element 28010F. US Air Force contractor (System and Applied Sciences Corporation) started the concept definition phase and began the preparation of a proposal for full-scale development.

(2) (U) FY 1983 Program: The contractor will complete concept definition phase and will provide a proposal for the beginning of full-scale development. The program was transferred from the US Air Force to the US Army by Under Secretary of Defense for Research and Engineering memorandum dated 6 December 1982. The transfer will be accomplished during FY 1983 and the remaining FY 1983 funds transferred to the US Army. A US Army project manager will be assigned and will develop an acquisition strategy and a required funding profile.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Full-scale development of the CSCE will be initiated. Hardware selection will be made and software development will be started.

(4) (U) Program to Completion: This is a continuing program; however, outyear funding has not yet been identified by the US Army due to the recent transfer of the program from the US Air Force.

c. (U) Major Milestones: Not Applicable.

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Program Element: #28016A

Title: Joint Tactical Communications (TRI-TAC) Program

DOD Mission Area: #345 — Tactical Communications

Budget Activity: #4 — Tactical Programs

I. (U) **TEST AND EVALUATION DATA:** This section provides test and evaluation data for the Automatic Communications Central Office, AN/TTC-39 Program (Project #D222). The AN/TTC-39 Program contains a family of modular and transportable communications switches which provide secure, automatic, processor-controlled switching for tactical voice and message traffic. Components of the family are hybrid (analog and digital) circuit switches (AN/TTC-39) varying in size from 450 (300-line) to 750 terminations (600-line) and a 50-line digital message switch (AN/TYC-39).

1. (U) **Development Test and Evaluation:** The Development Test (DT) II of the AN/TYC-39 message switch started in July 1978 and was successfully completed in May 1979; the DT II of the AN/TTC-39 circuit switch started in November 1979 and was successfully completed in May 1980. All subsystems and support equipment except the AN/MSM-105 automatic test equipment were available for test.

a. (U) GTE Sylvania, Needham, MA, was the development contractor and the test support contractor. The Army Program Manager is Program Manager, Multiservice Communication Systems (PM MSCS), Fort Monmouth, NJ. DT was conducted by the Digital Communications Test Company, US Army Electronic Proving Grounds (USAEPG), US Army Test and Evaluation Command (USATECOM). The US Air Force (USAF), US Navy (USN), US Marine Corps (USMC), and National Security Agency (NSA) also participated in the conduct and evaluation of the tests.

b. (U) The Joint Test Facility, Fort Huachuca, AZ, as well as the remote operating areas around Fort Huachuca, AZ, provided the primary facilities for conducting DT II of the AN/TTC-39 and AN/TYC-39 program. However, interoperability tests were also conducted with the Naval Telecommunications System Test Node (NTSTN) located at San Diego, CA. Testing was conducted by military personnel from appropriate communications units. Contractor support continued during testing. EMP testing was conducted by personnel from US Army Electronics Research and Development Command (USAERADCOM) Harry Diamond Laboratories (HDL) at the HDL Woodbridge, VA, research facility.

c. (U) During testing the AN/TYC-39 message switch and AN/TTC-39 circuit switches demonstrated capabilities far greater than inventory equipment; however, hardware changes were required to enable the switches to satisfy the organizational level mean time to repair objective. With these changes, the logistics supportability was determined to be adequate.

d. (U) All of the hardware deficiencies identified during testing have been resolved, and appropriate design changes have been included in the production baseline. The software deficiencies have been corrected under a continuing development program; each software upgrade has been extensively tested prior to release. Production baseline software was accepted by the Government in March 1982 for the AN/TTC-39 and in August 1982 for the AN/TYC-39. Software verification with production models will be accomplished during Production Acceptance Test and Evaluation.

2. (U) **Operational Test and Evaluation:** The Operational Test (OT) II of the AN/TYC-39 started in February 1979 and was successfully completed in May 1979; the OT II of the AN/TTC-39 started in November 1979 and was successfully completed in May 1980. All subsystems and support equipment except the AN/MSM-105 automatic test equipment were available for test.

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Program Element: #28010A

Title: Joint Tactical Communications (TRI-TAC) Program

DOD Mission Area: #345 — Tactical Communications

Budget Activity: #4 — Tactical Programs

a. (U) OT II was conducted by the United States Army Operational Test and Evaluation Agency with the support of the TRI-TAC Joint Test Organization at Fort Huachuca, AZ. The United States Air Force, Navy, Marine Corps, and the National Security Agency participated in the conduct and evaluation of the tests. Interoperability tests were also conducted with the Naval Telecommunications Test Node at San Diego, CA, and deployments were made to CONUS Air Force bases to simulate tactical airbase operations. Testing was performed by military personnel from representative communications units. Contractor support continued during testing.

b. (U) Service Independent Evaluation Reports stated that the tested system and software were effective for employment within each Service's range of operational requirement. However, several areas were identified as needing improvement. The areas identified were training, documentation, software, and Reliability, Availability, and Maintainability (RAM). The US Army Signal Center prepared a new program of instruction to correct the training deficiencies. The Services agreed to convert the documentation to the skill performance aid (SPA) format. The software corrections were implemented on a time-phased basis to minimize impact of switch use at the Joint Test Facility; production baseline software was accepted by the Government in March 1982 for the AN/TTC-39 and in August 1982 for the AN/TYC-39. Follow-on testing was required by the Secretary of Defense Decision Memorandum approving the production decision to demonstrate that the RAM deficiencies had been corrected. A US Army Operational Test and Evaluation Agency report (Dec 81) indicated that significant RAM improvement had been made. Follow-on evaluations of production equipment are scheduled in March 1983 for the AN/TYC-39 and in September 1983 for the AN/TTC-39.

3. (U) System Characteristics: The operating and technical characteristics listed below are those which have been approved by OSD in Decision Coordinating Paper (DCP) 135, January 1977, and cover sheet update in August 1979 and the DSARC III. The demonstrated performance characteristics listed below have been derived from Government-witnessed Contractor Development Testing (CDT), DT II, and OT II.

Operational/Technical Characteristics	Objectives	Demonstrated Performance
AN/TTC-39 CS (800-Line/300-Line)		
Inherent availability (hrs) ¹	.999/.999	.9975/.9991
Mean time between mission failure (hrs)	²	142.5
Mean time between unscheduled maintenance actions (hrs)	20/30	11.6/10.8 ³

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Program Element: #28010A

Title: Joint Tactical Communications (TRI-TAC) Program

DOD Mission Area: #345 — Tactical Communications

Budget Activity: #4 — Tactical Programs

Operational/Technical Characteristics	Objectives	Demonstrated Performance
Mean time to repair (min) (organizational/DS)	30/30	40.5 ^a
Mean time to repair (min) (GS)	80/80	107 ^a
Simultaneous conferences ¹	6/4	47
Maximum conferees per conference ¹	20/20	67
Alternate routing ¹	up to 5/5	5 ^a
Standby battery power (min)	15/15	20 (lead acid)
Terminations per module	150/150	192/192
Maximum weight per shelter (lbs)	7000/7000	6709/8386
AN/TYC-39 Message Switch (50-Line)		
Inherent availability ¹	.999	.963 ^a
Mean time between mission failures (hrs)	²	116.3
Mean time between unscheduled maintenance actions (hrs)	20	16.7 ^a
Mean time to repair (min) (organizational/DS)	30	58.5 ^a
Mean time to repair (min) (GS)	80	50.6
Reference storage (days) ¹	10	10
Journal storage (days)	10	10
Standby battery power (min)	15	16.26
Message processing time (sec) ³	2	1.732
Throughput character per second	9000	9534
Bit error rate per consecutive bits	10 ⁻¹⁰	10 ⁻¹⁰
Maximum weight per shelter (lbs)	7000	6840

NOTES:

¹ (U) DCP performance features for which minimum thresholds for the Army have been established.

² (U) No specific criteria established. User stated a desire for the switches to be capable of performing a 48-hour mission without a mission failure.

³ (U) Two seconds represent a mean message processing time.

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Program Element: #28010A

Title: Joint Tactical Communications (TRI-TAC) Program

DOD Mission Area: #345 — Tactical Communications

Budget Activity: #4 — Tactical Programs

⁴ (U) 0.963 is a measure of operational availability and includes maintenance and supply time.

⁵ (U) Figures based on average of 600-line and 300-line switch.

⁶ (U) Correction to be verified during follow-on testing.

⁷ (U) Demonstrated capability limited by testing scenario, not equipment limitation.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #33148A

Title: EUCOM C³ Systems

DOD Mission Area: #341 — Theater Command and Control

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	6015	527	3991	7653	Continuing	Not Applicable
DH68	EUCOM C ³ Systems	6015	527	3991	7653	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The communications deployed to support command and control of US European Command (USEUCOM) Theater Nuclear Forces (TNF) have been criticized for several years as The existing TNF command and control communications (C³) system is A replacement system is needed that The Army was tasked as the Executive Agent for the Department of Defense to manage the upgrade of TNF communications as a high-priority item. This program element exists to implement that direction. Until now, TNF C³ has been exercised primarily by a nonsecure telephone system, the European Command Control Console System (ECCCS), and a high-frequency radio net, known as the CEMETERY NET. Under this program, the ECCCS has been extended and upgraded to pass secure teletype as well as voice. The major fixed sites of the CEMETERY NET have been modernized and improved. A satellite-based system, the FLAMING ARROW NET, has also been procured to provide an alternate route for critical nuclear command and control messages. The FLAMING ARROW NET is now being fielded. The need remains to replace the CEMETERY NET with a high-frequency radio system that will provide That system, named REGENCY NET, is to be procured as a nondevelopmental item under this program. The program will continue to develop and field state-of-the-art upgrades to these new systems to preclude in recognition of the critical need to upgrade these systems. In addition, procurement funds in this program will provide the US Commander-in-Chief, Europe (CINCEUR) with the facilities and equipment that will adequately support peace, crisis, and wartime missions by modernizing CINCEUR war headquarters facilities in accordance with Secretary of Defense guidance.

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Program Element: #33145A

Title: EUCOM C³ Systems

DOD Mission Area: #341 — Theater Command and Control

Budget Activity: #4 — Tactical Programs

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	8015	527	3991	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	4016	527	4948	Continuing	Not Applicable

Fund increase in FY 1982 was due to reprogramming to provide for development of the Tactical Advanced Narrowband Radio, a possible state-of-the-art upgrade to REGENCY NET. Funds decrease in FY 1984 is due to realignment within the EUCOM C³ program and revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement, Army Funds (current requirements)	- 0 -	34500	102400	68600	238300	443800

Funds increases in all years after FY 1983 are due to restructuring of the program, results of an updated Independent Government Estimate, and because the cost of the EUCOM War Headquarters was omitted from in the FY 1983 submission by error. Funds decrease in FY 1982 is due to delay in initiating procurement because of restructuring the program and redefinition of acquisition strategy.

*Variety of types of radios and command post equipment.

E. (U) RELATED ACTIVITIES: Satellite communications terminals for the FLAMING ARROW NET are being developed and procured under Program Element #33142A, managed by the US Army Satellite Communications Agency. Close coordination is maintained between programs to ensure that there is no duplication of effort.

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Program Element: #33146A

Title: EUCOM C³ Systems

DOD Mission Area: #341 — Theater Command and Control

Budget Activity: #4 — Tactical Programs

F. (U) WORK PERFORMED BY: BDM Corporation, McLean, VA; Harris Corporation, Rochester, NY. Developing organization: US Army Communications Systems Agency, and Project Manager, Defense Communications Systems (Army), Fort Monmouth, NJ. In FY 1982, this program completed upgrades to the European Command Control Console System and portions of the CEMETERY NET. Development of REGENCY NET specifications was begun.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: DH58—EUCOM C³ Systems: The thrust of this program in FY 1983 is to complete the action for REGENCY NET. Specifically, the Request for Proposal will be released to industry, source selection will take place, and a contract will be awarded. RDTE efforts in FY 1984 will consist of program office operations and the initiation of development efforts for the Tactical Advanced Narrowband Radio as well as other techniques for enhancing the performance of the REGENCY NET. Work will be initiated in networking techniques and the integration of satellite and other communications to provide maximum reliability and survivability for REGENCY NET.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63215A

Title: Joint Survivability Investigations

DOD Mission Area: #225 — Air Warfare Support

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	820	1100	1077	1165	Continuing	Not Applicable
D079	Joint Survivability Investigations	820	1100	1077	1165	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides the Army's contribution to the Tri-Service Joint Aircraft Survivability Program. The program operates under the aegis of the Joint Logistics Commanders, and is conducted by the Joint Technical Coordinating Group on Aircraft Survivability (JTCG/AS). Efforts are directed at improving the survivability of US aircraft in the nonnuclear threat environment. The JTCG/AS mission is to: (1) coordinate research and advanced development efforts, plan and propose joint critical technology programs contributing to the reduction of vulnerability, and the improvement of survivability in aeronautical systems in a combat environment; (2) review and analyze data on combat damage; (3) conduct studies of future threat environments to determine survivability requirements and to assess enhanced survivability design features; (4) plan and coordinate joint Service tests and maintain cognizance over single-Service tests to validate improved survivability design features. The JTCG/AS is required by its charter to promote survivability/vulnerability as a design discipline and coordinate research and development results among the Services and industry. The Joint Logistics Commanders endorse the JTCG/AS as a continuing program.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	820	1100	1077	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	930	1103	1117	Continuing	Not Applicable

Reduction of \$110 thousand in the FY 1982 funding level is a result of reprogramming to higher priority Army requirements. The funding decrease of \$3 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. The funding decrease of \$40 thousand in FY 1984 resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #63215A

Title: Joint Survivability Investigations

DOD Mission Area: #225 — Air Warfare Support

Budget Activity: #4 — Tactical Programs

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program is related to Air Force (PE# 63244F) and Navy (PE# 63262N) programs to insure improved aircraft survivability in nonnuclear threat environments. Coordination of these efforts is accomplished through a JTCG/AS Central Office staffed by Service representatives from each command represented on the Joint Logistics Commanders Group. Duplication is avoided through joint reviews by that office and individual Service task agencies. This program is specifically related to Army Program Element numbers 63711A (EW Self-Protection), Project number D653 (Aircraft Survivability Equipment), an Advanced Development Program, and Program Element #64711A (EW Self-Protection), Project Number D665 (Aircraft Survivability Equipment), an Engineering Development Program. Additionally, coordination is effected with existing and planned programs of the Federal Aviation Administration, NASA, and elements of the NATO countries.

F. (U) WORK PERFORMED BY: Ballistic Research Laboratory, Aberdeen Proving Ground, MD; US Army Research and Technology Laboratory, Fort Eustis, VA; Naval Weapons Center, China Lake, CA; Naval Research Laboratory, Washington, DC; US Army Materials and Mechanics Research Center, Watertown, MA; and Air Force laboratories.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: D079 — Joint Survivability Investigations: This project coordinates individual Service programs to increase the survivability of aeronautical systems in a nonnuclear threat environment, implements efforts to complement the Services' survivability programs, and maintains close liaison with Service levels to ensure that all survivability research and development data and systems criteria are made available to the developers of aircraft. JTCG/AS programs have saved or avoided \$21,792,000 in calendar years 1981 and 1982 and will yield additional cost avoidances of \$15,700,000 over the Five-Year Defense Program (FYDP). The active Halon fire-suppression system is presently being evaluated for the AH-1S. Development of a low-cost armored/crashworthy seat for the Army UH-60A Blackhawk helicopter replaced a more costly, less survivable design and saved \$792,000 in 1981-82. Use of this seat will yield an additional cost avoidance of \$15 million over the FYDP after the Blackhawks are equipped. In FY 1983 the JTCG/AS is funding and closely monitoring 74 separate survivability tasks which are being performed at 20 different Army, Navy, Air Force, and NASA laboratories/activities. Principal milestones for FY 1983 are to: develop field expedient powder packs for fire protection; investigate advanced small engine vulnerability reduction; determine survivability of joints in composite structures and high-temperature adhesives; evaluate high-performance armor materials and develop penetration data; continue development/evaluation of combat damage-tolerant, radar camouflage composite structural materials; continue standardization of infrared measurement techniques; and develop/evaluate multi-layer canopy laser countermeasure materials. In FY 1984 the program will continue research and development to: investigate advanced small engine vulnerability reduction techniques; determine survivability of joints in composite structures; complete characterization of 30mm high explosive round; investigate survival of insulative char layers under pulsed mechanical loads; and evaluate multilayer canopy laser countermeasures materials. Initiate research and development to: investigate transparent armor materials; evaluate experimental high-performance armor materials; test mechanical flight control components (helicopter); investigate heavy metal-bearing resins/laser interactions; characterize integral fiber optics/composite structures; and continue development of standard infrared measurement procedures and techniques.

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Program Element: #63215A

Title: Joint Survivability Investigations

DOD Mission Area: #225 — Air Warfare Support

Budget Activity: #4 — Tactical Programs

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63217A

Title: Greater Slope

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	19943	19293	29157	CLASSIFIED	CLASSIFIED
D024	Greater Slope	- 0 -	19943	19293	29157	CLASSIFIED	CLASSIFIED

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Program content is SECRET/No Foreign Dissemination, precluding further description in this summary. Classification authority and access are controlled by Headquarters, Department of the Army. Proponency is in the Office of the Deputy Chief of Staff for Research, Development, and Acquisition.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands) Not Applicable. No RDTE Congressional Descriptive Summary (CDS) was submitted in FY 1983.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: See paragraph B above.

F. (U) WORK PERFORMED BY: See paragraph B above.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: See paragraph B above.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: See paragraph B above.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63256A

Title: Joint Services Vertical Lift Aircraft (JVX) Development Program

DOD Mission Area: #322 — Tactical Intelligence and Related Activities for Tactical Land Warfare

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	29915	38497	98427	894061	1061400*
D209	Modern Technology Engine	- 0 -	- 0 -	291	1071	235738	237100
D210	Intelligence/Electronic Warfare Systems Integration	- 0 -	- 0 -	5727***	5029***	10044***	20800***
D211	Joint Services Advanced Vertical Lift Aircraft	- 0 -	29915**	30479**	93327**	648279**	803500**

* Includes \$1500 thousand funded in PE 63211A in FY 1982

** Funds from 64222A

*** Funds from 63222A

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Joint Services Vertical Lift Aircraft (JVX) will provide the Army, Navy, Air Force, and Marine Corps with the ability to conduct combat, combat support, and combat service support missions requiring vertical takeoff and landing capabilities. JVX will replace a number of aging, obsolescent aircraft not adequately capable of performing assigned missions and will also provide for expanded mission capabilities. The primary Army mission requires Special Electronic Mission Aircraft (SEMA) in support of airborne intelligence collection and electronic warfare. The JVX-SEMA will replace the OV-10, RU-21A/B/C/H, RC-12D, EH-1, and the EH-60 Aircraft.

UNCLASSIFIED

UNCLASSIFIED

Program Element: #63268A

Title: Joint Services Vertical Lift Aircraft (JVX) Development Program

DOD Mission Area: #322 — Tactical Intelligence and Related Activities for Tactical Land Warfare

Budget Activity: #4 — Tactical Programs

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	- 0 -	29915	36497	983488	1061400*
Funds (as shown in FY 1983 submission)	- 0 -	51270	95866	TBD	TBD

* Includes FY 1982 funds in PE 63211A

The difference in FY 1983 funding requirements is due to action of the Joint Authorization Conference. The FY 1984 funding requirement difference of \$59369 thousand is due to program adjustments after the acquisition strategy was approved. The remaining FY 1984 reduction of \$1303 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget. The funding shown is the Army's share of the joint program and is in escalated dollars. The current funding requirement is based on parametric or analogy cost estimating methods and has not been validated. Funds for project D209 and D210 are included above. In the FY 1983 submission, funds for project D209 were shown in program element 64216A and project D210 funds were shown in program element 63222A.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement, Army:						
Funds (current requirements)	- 0 -	- 0 -	- 0 -	- 0 -	4436700*	4436700*
Quantities (current requirements)	- 0 -	- 0 -	- 0 -	- 0 -	284	284

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Program Element: #63256A

Title: Joint Services Vertical Lift Aircraft (JVX) Development Program

DOD Mission Area: #322 — Tactical Intelligence and Related Activities for Tactical Land Warfare

Budget Activity: #4 — Tactical Programs

* Dollar estimates are in constant FY 1983 dollars

E. (U) **RELATED ACTIVITIES:** The JVX is a joint Army, Navy, Air Force, Marine Corps project with the Navy as Executive Service in accordance with the joint memorandum of understanding, 4 June 1982, and subsequent Secretary of Defense decision memorandums. Program objectives include the following: development of a common advanced technology vertical lift aircraft capable of meeting multimission service requirements, while achieving a significant increase in performance over current aircraft; reducing Department of Defense costs through execution of joint development program for a common aircraft; achievement of the earliest practical Initial Operational Capability. A memorandum of agreement addressing acquisition strategy, program management resources, and coordination/communication is to be approved by the Services. In FY 1982, funds were provided by each Service in the amount of \$1.5M to accomplish a joint technology assessment, draft the joint Service operational requirements, organize a Project Manager's Office (PMO) and prepare a Request for Proposal (RFP). OSD reviewed the acquisition strategy on 15 November 1982 and approved release of the competitive request for proposal to industry for the preliminary design phase. During this phase, industry will develop the JVX design, conduct extensive wind tunnel tests, simulations, and complete a proposal for the balance of the program. The purpose of this 23-month effort is to clearly define the cost, risks, and schedule before continuing with the major portion of the program.

F. (U) **WORK PERFORMED BY:** Up to two contractors will be competitively selected to perform the work described in paragraph E. The contractors will be selected in early FY 1983. Principal in-house agencies will be the Army Aviation Research and Development Command, St. Louis, MO, the Naval Air System Command, and the Air Force Systems Command.

G. (U) **PROJECTS LESS THAN \$10 MILLION IN FY 1984:**

1. (U) **D200 — Modern Technology Engine (MTE) (New Start):** The MTE Engineering Development program will provide a modern turbine engine with significant improvements in specific power and fuel consumption, alternate fuel usage, reliability, durability and maintainability. Multi-Service applications include, but are not limited to, the Joint Services Advanced Vertical Lift Aircraft (JVX), the Army CH-47D and the Navy P-3. The Army will fund and complete its FY 1983 initiated Modern Technology Demonstrator Engine (MTDE) Advanced Development program being conducted under program element number 63201A. The Army will continue as executive Service for the joint full scale engineering development of the MTE with participation from the other Services. In FY 1984, the full scale Engineering Development Statement of work for the MTE will be initiated and a Request for Proposal (RFP) prepared. In FY 1985, long leadtime items will be identified and procured to support the FY 1986 initiated development and flight qualification program. The MTE RFP will be released to industry in the second quarter, FY 1985.

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Program Element: #63256A

Title: Joint Services Vertical Lift Aircraft (JVX) Development Program

DOD Mission Area: #322 — Tactical Intelligence and Related Activities for Tactical Land Warfare

Budget Activity: #4 — Tactical Programs

2. (U) D210 — Intelligence/Electronic Warfare Systems Integration : The FY 1984 request is for Intelligence/Electronic Warfare Systems Integration for the Special Electronic Mission JVX. The JVX aircraft design must consider the integration, layout, and functions of the sensors required to perform special-purpose missions. Antenna pattern analysis, propeller modulation, interference and electrical power requirements must be identified and proceed in parallel with the JVX development. Project initiation is required to insure that basic data are available to evaluate intelligence and electronic warfare mission applications and to begin a program that will allow critical design features, such as antenna locations, to be tested and problems solved.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: D211 — Joint Services Advanced Vertical Lift Aircraft

a. (U) Project Description: The JVX will provide the Army, Navy, Air Force, and Marine Corps with the ability to conduct combat, combat support, and combat service support missions requiring vertical takeoff and landing capabilities. JVX will replace a number of aging, obsolescent aircraft not adequately capable of performing assigned missions and will also provide for expanded mission capabilities. The primary Army mission requires Special Electronic Mission Aircraft (SEMA) in support of airborne intelligence collection and electronic warfare, and the JVX will replace the existing SEMA systems.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: A Joint Services Operational Requirement was staffed, a Joint Technology assessment was conducted, a Joint Services Memorandum of Understanding signed, and a Request for Proposal (RFP) was prepared for release to industry. JVX is a FY 1983 new start.

(2) (U) FY 1983 Program: The RFP was released to industry on 17 January 1983. Proposals will be evaluated to support selection of up to two competitors who will conduct a series of wind tunnel tests, construct mock-ups, develop math models to be used to simulate JVX on the National Aeronautics and Space Administration (NASA) Vertical Motion Simulator, conduct trade-off studies to identify the cost and weight drivers of JVX, and make cost estimates for the program.

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Program Element: #63256A

Title: Joint Services Vertical Lift Aircraft (JVX) Development Program

DOD Mission Area: #322 — Tactical Intelligence and Related Activities for Tactical Land Warfare

Budget Activity: #4 — Tactical Programs

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: The JVX preliminary design effort started in FY 1983 will continue in FY 1984 with the addition of contractual effort in start-up of limited detail design and prototype producibility engineering to concurrently prepare for entering Full-Scale Engineering Development in FY 1985.

(4) (U) Program to Completion: Full Scale-Engineering Development and Testing of prototype air vehicles.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
Preliminary Design Contract Award	2Q FY 1983	Not Applicable
Full-Scale Engineering Development Contract Award	3Q FY 1985	Not Applicable
Long Lead Release	3Q FY 1987	Not Applicable
Full Production Release	1Q FY 1994	Not Applicable
First USMC delivery	3Q FY 1991	Not Applicable
USA/USAF/USN delivery	1Q FY 1993	Not Applicable

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63302A

Title: Antitactical Missile (ATM)

DOD Mission Area: #214 — Ground-Based Antiair and
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		- 0 -	10000	33275	148927	To Be Determined	To Be Determined
D099	Antitactical Missile	- 0 -	10000	33275	148927	To Be Determined	To Be Determined

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Joint Antitactical Missile (ATM) program has been initiated based upon the . The program will be executed in two concurrent phases directed toward near-term and long-term solutions. The near-term program is an accelerated evaluation of DOD . The evaluation will be followed by product improvement of selected systems to provide the . Current and emerging air defense systems have an inherent capability against portions of the tactical missile threat spectrum. Product improvements to these systems provide the fastest means to counter a portion of the threat (including cruise missiles). Long-term options will include a complete joint systems approach to define the overall concept for countering the . This approach will encompass all . Initial long-term concepts will include examination of: existing and developmental radar systems to be used for early warning, tracking, and targeting of tactical ballistic missile systems; satellite surveillance for detecting tactical missile system locations and launches; airborne radars for detecting tactical missile launches and tracking during flight; and command, control, communication, and intelligence systems necessary to transfer tactical missile system targeting data to the offensive counterstrike forces capable of attacking tactical missile systems.

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Program Element: #83302A

Title: Antitactical Missile (ATM)

DOD Mission Area: #214 — Ground-Based Antiair and
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	- 0 -	10000	33275	To Be Determined	To Be Determined
Funds (as shown in FY 1983 submission)	- 0 -	27172	34548	To Be Determined	To Be Determined

The funding decrease of \$17172 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act. The FY 1984 reduction of \$1273 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Long-term nonnuclear kill technology development is being performed by the Ballistic Missile Defense Office. Specific technology areas which are applicable to include: The Army has a Battlefield Integration Working Group, comprised of representatives from Patriot, Hawk, and AN/TSQ-73 Project Offices, which is coordinating air defense battle management efforts. The Navy also has a research and development effort to provide a nuclear payload for the Standard Missile-II (SM-II). This research and development effort will be completed in FY 1986. There is a Joint Army/Navy SAM technology program to develop a

F. (U) WORK PERFORMED BY: Industry participation will be dependent on the results of the in-house system evaluation of all systems for the near-term solution. Government agency in-house work will be performed by the US Army Missile Intelligence Agency, Huntsville, AL; US Army Armament Research and Development Command, Picatinny Arsenal, NJ; Harry Diamond Laboratories, Adelphi, MD; Ballistic Research Laboratory, Aberdeen Proving Ground, MD; US Army Missile Command, Redstone Arsenal, AL; the Ballistic Missile Defense Office, Huntsville, AL; Naval Surface Weapons Center, White Oak, MD; and other Service/Government research activities. The program is being defined and developed under the direction of a DOD Steering Committee with Service participation.

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Program Element: #63302A

Title: Antitactical Missile (ATM)

DOD Mission Area: #214 — Ground-Based Antiair and
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: D080 — Antitactical Missile

a. (U) Project Description: The current tactical missile threat (including TBMs and cruise-type missiles) is . This significant . Because of the , an antitactical missile capability is required. The active defense will provide a although it is technically more difficult and will take longer than the development and introduction of passive measures. The active defense program is designed to provide both a near-term and a long-term solution. The near-term ATM program will concentrate on modification and/or product improvements to existing systems to field the earliest possible capability. . Current system software improvements will include enhancing the . The long-term effort will develop a and will consider growth options for existing or emerging air defense systems and combinations of these systems . If evolutionary approaches are determined to be inadequate, new system concepts taking full advantage of Ballistic Missile Defense Office (BMDO) technology will be developed and evaluated. Development and management of the ATM effort will be organized as a multi-Service effort with overall coordination by the Office of the Secretary of Defense. The Army is the lead agency. Specific service requirements and concepts for both passive and active defense requirements as well as requirements will be considered in developing the overall system concept and definition for the ATM system. Technologies from several different mission areas (intelligence, tactical missile defense, antiship missile defense, ballistic missile defense, counterair, etc.) will be evaluated to develop an integrated approach to counter the long-term tactical missile threat.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) FY 1982 Accomplishments: Performance analysis to support Army Science Board (ASB) and Defense Science Board (DSB) studies on antitactical ballistic missiles (ATBM) has resulted in data useful in supporting concept definition.

(2) (U) FY 1983 Program: Program initiated in FY 1983. Development efforts on existing systems were initiated. Warhead and fuze analysis, development of performance parameters, and technical system characterization were conducted in FY 1983

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request:

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Program Element: #63302A

Title: Antitactical Missile (ATM)

DOD Mission Area: #214 — Ground-Based Anti-air and
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

(a) (U) Near-Term: Develop/modify detailed air defense system simulations to be used in performing the systems analysis/systems engineering tasks needed to refine the design requirements for product improvements identified for existing air defense system. Continuation of . An evaluation of existing system capabilities will be completed, and a modification matrix will be postulated in order to maximize system performance.

(b) (U) Long-term: Joint concept studies to identify specific advanced technology requirements necessary to counter all projected tactical missile threats will be initiated in parallel with the near-term effort. These studies will include consideration of all Service requirements for antitactical missile capabilities. Kill concepts will be examined. Tri-Service ATM requirements will be consolidated and baselines established.

(4) (U) Program to Completion: Near-term: The initial will be completed. The will be completed. The . The . A flight test program incorporating the and will be conducted initially to prove out the additional . Modifications and adaptations of other existing systems to obtain the optimum ATM capability will be completed. Long-term: Continue technology for satellite warning and radar acquisition and tracking, infrared acquisition, and missile guidance requirements. Jointly develop generic systems and initiate trade-off analyses to establish a baseline. A competitive concept definition for the long-term program will be undertaken. Advanced development for the long-term armaments package will start in , and follow-up engineering development will be initiated in late

(5) (U) Use by Foreign Governments: and could be interested in obtaining this added ATM capability.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
Joint Service Requirements	Sep 1984	Not Shown
Long-Range System Baseline		Not Shown
New/Evolutionary System Definition		Not Shown
ATM Hardware Production (Product Improvement)		Not Shown
IOC (Enhanced Anti-Cruise Missile)		Not Shown
ATM Interim Capability (Product Improvement)		Not Shown

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63363A

Title: Surface-to-Surface Missile Rocket System

DOD Mission Area: #223 — Close Air Support and
Interdiction

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	990	6382	20442	27131	239245	294971
D216	Multiple Launch Rocket System (MLRS)						
	Terminal Guidance Warhead (TGW)	990	6382	20442	27131	239245	294971

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The concept of a Terminal Guidance Warhead (TGW) for the Multiple Launch Rocket System (MLRS) envisions the attack of armored targets from above using highly accurate and lethal submunitions dispensed from an MLRS rocket. There is an urgent need for an autonomous, terminal homing, indirect fire-and-forget capability to defeat hard point targets such as armored vehicles and equipment before they are committed into the central battle, thereby reducing their presentation rate. The TGW for the MLRS will contain multiple submunitions packaged within the rocket warhead section. The Army intends to develop this warhead in cooperation with France, Germany, and the United Kingdom.

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Program Element: #63303A

Title: Surface-to-Surface Missile Rocket System

DOD Mission Area: #223 — Close Air Support and
Interdiction

Budget Activity: #4 — Tactical Programs

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	990	6382	20442	267186	294971
Funds (as shown in FY 1983 submission)	2989	16407	31224	138390	189791

The RDTE funding request in this submission is based on the results of the ASSAULT BREAKER Demonstration and the multinational analysis of the six contractor-prepared Concept Definition studies submitted to the governments in June 1982. It is a substantial increase in the total RDTE cost estimates from the 1983 submission. The increase is caused by a longer development program and more extensive test program, and it reflects a more detailed understanding of the fire-and-forget smart munition end game. The studies indicate that an antiarmor system with an advantageous cost-to-kill ratio can be developed. The ASSAULT BREAKER Demonstration has provided data that indicate the development risk is low for this weapon system. The funding decrease of \$10 million in FY 1983 is a direct result of Congressional direction in the FY 1983 Appropriations Act. The funding decrease of \$10 million in FY 1984 is the result of an internal Army decision to pursue the multinational development program, thereby reducing the US funding requirement.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) If the US enters into a joint Validation and Maturation development program with its European partners, it is anticipated those nations will each fund 20% of the development costs. The exact shares to be funded by each nation will be determined during negotiations of the Validation Phase Memorandum of Understanding (MOU) Supplement. The current profile assumes that the US is funding 40% of the RDTE costs. At this time, funding from other US appropriations for the program is not anticipated during the next four years. Procurement costs will be developed by using data from the Cost and Operational Effectiveness Analysis (COEA) and the Design-to-Unit-Production Costs (DTUPC) to be completed for the June 1983 ASARC.

E. (U) RELATED ACTIVITIES: The Under Secretary of Defense for Research and Engineering directed the Defense Advanced Research Projects Agency (DARPA) to develop the emerging technologies and demonstrate the potential of a long-range antiarmor capability. The resulting DARPA technology demonstration, known as "Assault Breaker," used a long-range Army carrier missile with midcourse correction capabilities, an Air Force radar system to locate/track targets and provide guidance to the carrier missile, submissiles with infrared Terminally Guided Submunitions (TGSM), and nonhoming target-sensing submunitions called "SHEET". The demonstration was conducted from January 1981 to December 1982. The Army, through its Missile Command, was directly involved as the contracting and coordinating agency for DARPA to obtain and test the carrier missiles.

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Program Element: #63303A

Title: Surface-to-Surface Missile Rocket System

DOD Mission Area: #223 — Close Air Support and
Interdiction

Budget Activity: #4 — Tactical Programs

submissiles, and submunitions. Although Assault Breaker was not initiated to validate MLRS-TGW, the MLRS-TGW program influenced the DARPA program during the initial stages of its demonstrations. The most significant MLRS influence was the sizing of the TGSM. DARPA's TGSM was sized 4" x 25" so that six of them could be packaged into the MLRS warhead. The MLRS-TGW Concept Definition studies and the Phase III Assault Breaker demonstrations were completed at nearly the same time. This made the maximum amount of data available to the multinational team that evaluated the MLRS-TGW Concept Definition studies. Day-to-day involvement of the Army Missile Command's Advanced Systems Concepts Office in the Assault Breaker demonstrations has assured that duplication of effort between Assault Breaker and MLRS-TGW was minimized.

F. (U) **WORK PERFORMED BY:** This program is managed by the MLRS Project Manager. A contractor for the TGW has not been selected. The Vought Corporation of Dallas, TX, prime contractor for the MLRS, will integrate the TGW with the basic MLRS system.

G. (U) **PROJECTS LESS THAN \$10 MILLION IN FY 1984:** Not Applicable.

H. (U) **PROJECTS OVER \$10 MILLION IN FY 1984:**

1. (U) **Project: D216 — Multiple Launch Rocket System (MLRS) Terminal Guidance Warhead (TGW)**

a. (U) **Project Description:** Efforts to provide an indirect fire terminal homing capability were initiated in 1970 on the hypothesis that a terminally guided system could be effective if delivered by a parent system to a preselected point in space, dispersed from a delivery vehicle, and caused to decelerate to a low velocity, allowing time for a seeker to automatically scan, locate, track, and guide the homing missile to the target. Between 1971 and 1976 a series of demonstration tests were conducted. In conjunction with these tests, basic seeker technology was being improved. Emphasis was placed on infrared and millimeter wave seekers. Subsequent studies conducted by the Army, although limited in scope, have shown that smart or guided munitions provide large increases in both mission and cost effectiveness. In June 1976, the FY 1977 Authorization Conference Report authorized \$5 million to the MLRS program with the understanding that the Army would include a terminal homing option for the system. In December 1977, the Army was advised that the basic MLRS program would not be accorded OSD support unless the Army reached agreement with its NATO allies for a joint development program. This admonishment was repeated in the Defense Systems Acquisition Review Council (DSARC) decision memorandum in February 1978. The Culver-Nunn legislation was quoted to emphasize both admonishments. Since that time, the Army has been involved in a series of continuing discussions: first, with representatives of Germany and later with representatives of the United Kingdom and France. These discussions led to formulation of a formal Memorandum of Understanding (MOU) which was quadrilaterally executed in July 1979. During negotiation of this MOU, it became clear that the Europeans desired to fully participate in the management of a future development of a Terminal Guidance Warhead if one should be required. The MOU was followed by a quadrilaterally developed Material Equipment Characteristics Document which was signed in May 1980, and a Declaration of Intent on the part of the four nations to negotiate an MOU supplement

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Program Element: #63303A

Title: Surface-to-Surface Missile Rocket System

DOD Mission Area: #223 — Close Air Support and
Interdiction

Budget Activity: #4 — Tactical Programs

that provided for joint development of the TGW. An MOU Supplement for a Concept/International Program Definition (C/IPD) phase was negotiated during 1980-81 and was signed in September 1981. Based on the content of that supplement, the Concept Definition studies were done by six teams of contractors. Each contractor team had at least one contractor from each country. The studies were funded equally by all four governments.

b. (U) Program Accomplishments and Future Efforts:

(1) (U) **FY 1982 Accomplishments:** Six contracts were awarded for performance of Concept Definition studies. The studies were completed and turned over to the governments in June 1982. Evaluation of the Concept Definition studies has been completed by a multinational team and program alternatives for development were recommended by them to the governments.

(2) (U) **FY 1983 Program:** A jointly agreed Request For Proposal (RFP) which incorporates the desired technical approach will be prepared and issued to industry. The RFP will require industry to provide in their proposals engineering evidence from trials that the technical solution proposed has met operational availability requirements to be specified in the RFP.

(3) (U) **FY 1984 Planned Program and Basis for Budget Year Request:** Proposals received in response to the RFP will be evaluated and a Validation Phase R&D contract will be awarded. During this phase of design validation and development, the contractor(s) will continue component design, design validation, engineering evaluation, component fabrication, testing, and system integration with the MLRS prime contractor.

(4) (U) **Program to Completion:** Tentative IOC planned for . This date must be reviewed after analysis of Concept Definition studies.

c. (U) **Major Milestones:** The major milestones listed below are as shown in the Materiel System Requirements Specification (MSRS) for Alternative I and represent the TGW Special Working Group preliminary schedule dates. Alternative I consists of Validation and Maturation Phases. The Validation Phase has two substages: a component demonstration and a system demonstration. Following the Validation Phase and a joint decision to proceed, the validated design will enter into the Maturation Phase, during which the design will be updated as necessary. The production qualification testing will also be conducted and the Technical Data Package (TDP) updated to incorporate changes resulting from testing. The deliverable technical information, including the TDP developed during the Maturation Phase, will be sufficiently complete for full-scale production in each participant nation although only one final production line is envisioned at this time.

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Program Element: #63363A

Title: Surface-to-Surface Missile Rocket System

DOD Mission Area: #223 — Close Air Support and
Interdiction

Budget Activity: #4 — Tactical Programs

Major Milestones	Current Milestone Dates ¹	Milestone Dates Shown in FY 1983 Submission
Complete Concept Definition Studies	June 1982	June 1982
Complete Army Systems Acquisition Review Council I (ASARC I)	June 1983	February 1983
Defense System Acquisition Review Council (DSARC I)	July 1983	Not Applicable
Award Validation Phase Contract(s)	September 1984	September 1983
Captive Flight Tests	February 1985	Not Applicable
ADVT Flights	February 1988	Not Applicable
Complete Army Systems Acquisition Review Council (ASARC II)	July 1988	Not Applicable
Complete Defense Systems Acquisition Review Council (DSARC II)	July 1988	Not Applicable
Maturation Contract Award	August 1988	Not Applicable
MDT Flight Tests	November 1988	Not Applicable
Complete Army Systems Acquisition Review Council (ASARC III)	TBD	Not Applicable
Complete Defense Systems Acquisition Review Council (DSARC III)	TBD	Not Applicable
LRP Contract Award	August 1988	Not Applicable
PQT Complete	October 1991	Not Applicable

¹ Milestone dates are based on the MLRS TGW Special Working Group preliminary schedule dates. Therefore, they are subject to change pending selection of the Best Technical Approach (BTA).

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63316A

Title: Advanced Rocket Control System

DOD Mission Area: #214 — Ground-Based Antiair and
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	- 0 -	31069	44974	72062	173505
D692	Advanced Rocket Control System	- 0 -	- 0 -	31069	44974	72062	173505

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Program content is SECRET "Limited Distribution — Special Access Required," precluding further description in this summary. Access to information is controlled by the Deputy Chief of Staff for Research, Development, and Acquisition, Department of the Army.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	- 0 -	- 0 -	31069	117036	173505
Funds (as shown in FY 1983 submission)	- 0 -	27869	53992	32226	135267

The elimination of funding in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act. The funding changes in FY 1984 and "Additional to Completion" reflect restructuring the program for an FY 1984 start.

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Program Element: #63316A

Title: Advanced Rocket Control System

DOD Mission Area: #214 — Ground-Based Antiair and
Tactical Missile Defense

Budget Activity: #4 — Tactical Programs

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable. Procurement is initiated in FY 1987.

E. (U) RELATED ACTIVITIES: This project is related to work in other Army technology programs. Duplication of effort is avoided by strictly controlling access to the project and limiting it to specific Department of Defense individuals involved in managing related technologies.

F. (U) WORK PERFORMED BY: Government in-house laboratories and contractors.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Details may be provided in accordance with paragraph b above.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63604A

Title: Nuclear Munitions and Radiacs

DOD Mission Area: #241 — Battlefield Theater Nuclear Warfare

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT QUANTITIES	2249	3453	.	.	Continuing	Not Applicable
D135	Nuclear Development Support	726	845	872	915	Continuing	Not Applicable
D153	Nuclear Effects Support Team (NEST)	959	1114	1094	1402	Continuing	Not Applicable
D443	Nuclear Projectiles Advanced Development	- 0 -	- 0 -			Continuing	Not Applicable
D483	Radiac Equipment Advanced Development	564	1494	5643	3546	Continuing	Not Applicable

* Prototype hardware is not procured in all these projects. For those where prototype hardware would be procured, program definition has not progressed to the point where quantities have been defined.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Army must maintain a viable capability to fight on the integrated nuclear battlefield. It is thus absolutely essential for the Army to have modern, effective, and safe nuclear weapon systems. The Army must also be able to effectively defend against the effects of the enemy's nuclear weapons. Effective defense in a nuclear environment requires modern burst and radiation detection and measurement devices. Finally, whether in an offensive or defensive posture, critical fielded systems must be survivable in a nuclear environment. The projects in this program comprise the Army's nuclear system Advanced Development efforts and also fund the management and engineering support structure required to interface with the Department of Energy and other weapon system developers.

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Program Element: #63804A

Title: Nuclear Munitions and Radiacs

DOD Mission Area: #241 — Battlefield Theater Nuclear Warfare

Budget Activity: #4 — Tactical Programs

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2249	3453		Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	3568	3480		Continuing	Not Applicable

In FY 1982, the \$1319 thousand decrease was due primarily to reprogramming of funds from Project D443 to higher priority requirements and deletion of funds from Project D148, ADM Fire and Control Systems, as a result of DA studies which showed that product-improvement of current Atomic Demolition Munition (ADM) Systems was not cost-effective. The \$7 thousand decrease in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. In FY 1984, a \$10361 thousand decrease was due primarily to realignment of funds in Project D443 to higher priority requirements and deletion of D148 funds for the reasons cited for the FY 1982 deletion, offset in part by an increase in requirements for Project D483. The remaining FY 1984 reduction of \$241 thousand resulted primarily from a revision of the anticipated inflation in the proposed Army RDTE budget.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program complements and is closely coordinated with Department of Energy (DOE) advanced development efforts. The outputs of exploratory development efforts in Program Element #62603A (Large Caliber and Nuclear Technology) are utilized. Tri-Service radiological detection programs are coordinated and integrated. Items in this program element progress to Engineering Development in related Program Elements #64603A (Nuclear Munitions) and #64706A (Radiological Defense Equipment). Nuclear Weapons Effects technology development from Program Element #62120A (Nuclear Weapons Effects/Fluidics) is used in this program element to transfer survivability and hardening technology to system developers.

F. (U) WORK PERFORMED BY: In-house efforts are performed at US Army Armament Research and Development Command, Dover, NJ; Harry Diamond Laboratories, Adelphi, MD; US Army Materials and Mechanics Research Center, Watertown, MA; and US Army Electronics Research and Development Command, Fort Monmouth, NJ. Principal contractor is Sandia Laboratories, Albuquerque, NM.

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Program Element: #63604A

Title: Nuclear Munitions and Radiacs

DOD Mission Area: #241 — Battlefield Theater Nuclear Warfare

Budget Activity: #4 — Tactical Programs

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D135 — Nuclear Development Support: The Project Manager for Nuclear Munitions has the responsibility to provide the nuclear engineering interface for project managers of systems having a nuclear capability with the Department of Energy, Army laboratories, and the Department of the Army Staff. He must also provide support to development efforts that pertain to generic nuclear programs (as opposed to a specific weapon system), and must fulfill life-cycle management responsibilities for stockpiled Army weapons. This project supports the Army's in-house nuclear engineering capability and staff in providing continuing technical advice and assistance in the development of Army nuclear systems.

2. (U) D153 — Nuclear Effects Support Team (NEST): Nuclear Hardening Technology must be applied during development of designated mission-critical Army systems. This project provides advice, technical expertise, guidance, limited test, and survivability assessments to project managers and materiel developers. It is the only Army effort of its kind. NEST provides the cross-walk required if nuclear hardening fixes developed in exploratory and advanced development efforts are to be incorporated in fielded equipment. NEST supports the development of hardened component inventory controls necessary to provide follow-on logistics support to hardened systems. In FY 1982 NEST participated in a series of Test Integration Working Group (TIWG) meetings and provided technical advice to various materiel developers. In FY 1983 and FY 1984, NEST will continue to provide technical advice to materiel developers and begin review of hardness assurance and hardness maintenance procedures for effectiveness in the field.

3. (U) D483 — Radiac Equipment Advanced Development: There is an urgent requirement to develop technology to upgrade Army burst and radiation detection equipment, which is old and bulky, has limited response capability, and cannot be efficiently employed from ground vehicles or aircraft. Advanced Development of state-of-the-art radiation detection and measuring equipment will provide commanders and medical personnel with radiation histories of units and individuals. Prototype systems will be developed, tested, evaluated, and feasibility established. In FY 1982, development of the Ground Electromagnetic Pulse and Optical Nuclear Detection System (GEONDS) was reinitiated. This system will automatically provide burst-yield-location-fallout probability information for corps and division headquarters. FY 1983 goals for GEONDS include: development of noseseeker and electromagnetic pulse (EMP) location subsystems, system software support, and design of optical and EMP field simulators. In FY 1984 GEONDS effort will continue. Advanced Development hardware fabrication and software and field simulators will be completed. Development testing will be initiated.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63612A

Title: Advanced Anti-Tank Weapon System (Formerly
RATTLER)

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -
D311	RATTLER	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -

B. (U) BRIEF DESCRIPTION OF PROGRAM ELEMENT: The Infantry must have the capability to combat numerically superior armored forces. Today the Infantry has the TOW, DRAGON, and LAW, respectively long-, medium-, and short-range weapons systems. The TOW allows the Infantry to kill tanks at long range, while the manportable medium- and short-range weapons provide the proliferation of systems necessary to deal with the high intensity of close combat with superior armored forces. The medium manportable weapon (DRAGON) provides a tank-killing capability for light forces. The DRAGON system is deficient in . The RATTLER was to replace the DRAGON system in the early 1990s. The RATTLER was to be a manportable weapon designed to correct the DRAGON system deficiencies and defeat armored vehicles and engage other hardpoint targets; as such, it would have played a key role in the light Infantry and Rapid Deployment Force (RDF) contingency missions.

C. (U) EXPLANATION OF CANCELLATION OR DEFERRAL: The Army decided to cancel the RATTLER because of affordability reasons. A laboratory effort is planned to continue to investigate and develop the most promising of competing technologies in order to reduce technological risks. Successful completion of the laboratory effort is necessary in order to achieve a lower cost antiarmor weapon program start in the future.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63615A

Title: Lethal Chemical Munitions Concepts

DOD Mission Area: #275 — Retaliatory Chemical Warfare

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	10149	- 0 -	15527	17399	Continuing	Not Applicable
DE76	Lethal Chemical Materiel	10149	- 0 -	15527	17399	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Union of Soviet Socialist Republics has developed and maintains a formidable offensive chemical warfare capability which presents a threat to survival of US and NATO forces. In contrast, the US has not produced any new chemical weapons since 1969. Consequently its stockpile is deteriorating and the number of usable munitions is decreasing. US policy requires a chemical weapons development program which will provide a credible deterrent/retaliatory capability. It is imperative that our efforts in research and development continue so as to reduce development leadtime for the manufacturing of chemical munitions should they be required for weapons systems in the future. This project provides for the transition of technology concepts into advanced development materiel. Additionally, the Department of Defense (DOD) has designated the Army Executive Agent for development of ground-launched munitions and all chemical agent requirements for all Services. There is no other DOD program which satisfies these needs.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	10149	- 0 -	15527	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	8157	13733	20377	Continuing	Not Applicable

Increase of \$1992 thousand in the FY 1982 funding level resulted from the addition of work on a Medium-Altitude Proximity Fuze for the 8-inch Intermediate Volatility Agent (IVA) chemical round. The funding decrease of \$13733 thousand in FY 1983 is a result of Congressional direction in the FY 1983 Appropriations Act. Reduction of \$4850 thousand in FY 1984 resulted from a two-year delay from FY 1984 to FY 1986 in the planned program start of the IVA chemical warhead for the Joint Tactical Missile System (formerly the Corps Support Weapon System), and a revision of the anticipated inflation in the proposed Army RDTE budget.

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Program Element: #63615A

Title: Lethal Chemical Munitions Concepts

DOD Mission Area: #275 — Retaliatory Chemical Warfare

Budget Activity: #4 — Tactical Programs

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: As directed by Department of Defense (DOD) Directive 5160.5, the Army has executive agent responsibility for the development of all lethal chemical agents and ground-launched munitions. Therefore, no comparable work is done by the other Services on such lethal chemical munitions development and agent processes. Each of the other Services sponsors engineering development on lethal chemical agent weapons unique to its requirements. Information is exchanged and the efforts are coordinated through technical documents, liaison officers, and by joint technical coordinating groups. Exploratory work leading to this Advanced Development effort is conducted under program element (PE) #62622A (Chemical Munitions and Chemical Combat Support). Items successfully completing Advanced Development are transferred to Engineering Development under PE #64610A (Lethal Chemical Munitions).

F. (U) WORK PERFORMED BY: US Army Chemical Systems Laboratory (CSL), Aberdeen Proving Ground, MD, which is the in-house Army developer for lethal chemical agent munitions; the Program Management Office, Multiple Launch Rocket System (MLRS), Redstone Arsenal, AL; the US Army Test and Evaluation Command (TECOM), Aberdeen Proving Ground, MD; and Dugway Proving Ground, Dugway, UT. Vought Corporation, Dallas, TX, has a contract to investigate MLRS chemical warhead interface problems.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) Project: DE76 — Lethal Chemical Materiel

a. (U) Project Description: The objective of this program is to conduct Advanced Development on binary lethal chemical agent munitions which have progressed from Exploratory Development and exhibit potential for casualty production through either the respiratory tract and/or penetration of environmental and protective clothing. Small-scale pilot units are designed and installed to obtain process engineering data for application to future production facilities. Chemical agent munitions concepts that employ the binary principle are evaluated. The program is essential to the development of a credible deterrent/retaliatory chemical warfare (CW) capability required by US national security policy and to counter the formidable CW threat posed by the Soviet Union.

b. (U) Program Accomplishments and Future Efforts:

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Program Element: #63615A

Title: Lethal Chemical Munitions Concepts

DOD Mission Area: #275 — Retaliatory Chemical Warfare

Budget Activity: #4 — Tactical Programs

(1) (U) FY 1982 Accomplishments: Advanced Development (AD) on the Multiple Launch Rocket System (MLRS) binary warhead continued. The MLRS binary warhead concept feasibility demonstration phase was continued by the Chemical Systems Laboratory and the Program Management Office, MLRS. A contract was awarded to the Vought Corporation for integration, design, development, and testing of the concept definition hardware. AD was continued for the 8-inch Intermediate Volatility Agent (IVA), XM 877, chemical warhead with detailed design efforts and developer tests. AD was initiated on the XM770 Medium-Altitude Proximity (MAP) fuze including formulation of design and trade-off analysis plus fabrication of human engineering turn on timers for evaluation. The 8-inch IVA program was terminated at the end of the fiscal year to permit adequate funding of the higher priority MLRS IVA warhead in FY 1983.

(2) (U) FY 1983 Program: All AD efforts on the MLRS binary warhead which require FY 1983 funds will be suspended as a result of Congressional direction in the FY 1983 Appropriations Act.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: AD will continue on the MLRS binary warhead. A warhead for flight tests will be designed. Agent characteristics will be established through laboratory tests. Materiel compatibility tests will be conducted as will twelve flight tests. Necessary design changes will be incorporated in MLRS.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
Resume AD on the MLRS Lethal Binary Warhead	4Q FY 1981	4Q FY 1981
Complete AD on the MLRS Lethal Binary Warhead	4Q FY 1987	4Q FY 1985

The Army has terminated development of the 155mm Binary IVA projectile and the 8-inch Binary IVA projectile. The two-year delay in completion of AD on the MLRS Lethal Binary Warhead (4Q FY 1985 to 4Q FY 1987) was the result of the Concept Feasibility Demonstration (CFD) phase not being funded in FY 1981, a subsequent delay in award of the CFD contract to the Vought Corporation which caused a comparable delay in completion of the Validation Demonstration Phase; and the Congressional direction in the FY 1983 Appropriations Act.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63619A

Title: Landmine/Barrier Systems

DOD Mission Area: #213 — Land Combat Engineer Support

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2365	8483	17043	18154	Continuing	Not Applicable
D005	Landmine Systems	1342	8207	10979	4363	Continuing	Not Applicable
D343	Robotic Obstacle Breaching Assault Tank (ROBAT)	- 0 -	- 0 -	3492	3888	2230	9610
D606	Countermine and Barrier Systems	1023	276	2572	9903	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objectives of this program are to improve Army countermine capabilities and provide for advanced development of new mine systems. Countermine equipment prototypes which facilitate maintenance of battlefield mobility and techniques to reduce the logistic burden normally associated with barrier systems are being investigated. Improved field fortification techniques are being devised and evaluated to improve battlefield survivability of friendly forces. Soviet and Warsaw Pact doctrine advocates the large-scale use of landmines in both offensive and defensive operations. In support of this doctrine, the Soviets have developed mechanized devices which rapidly lay minefields having a variety of complex mine fuzes. Mutually supporting countermine devices and techniques are required to meet this threat. New mine systems are being developed and tested under this program element by prototyping advanced development components, sensors, fuzes, logic networks, and power sources into complete mine systems. Mines provide a formidable obstacle to the massive tank threat posed by the Warsaw Pact and are required to fortify natural obstacles such as defiles, woods, rivers, and builtup areas in order to delay, canalize, and interdict attacking forces and enhance the performance of direct and indirect fire weapons.

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Program Element: #63619A

Title: Landmine/Barrier Systems

DOD Mission Area: #213 — Land Combat Engineer Support

Budget Activity: #4 — Tactical Programs

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	2365	8483	17043	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	6050	4595	19932	Continuing	Not Applicable

The reduction of \$3685 thousand in the FY 1982 funding level is a result of reprogramming to other Army mine programs, mainly PE #64619A/D088, the Modular Pack Mine System (MOPMS). The funding increase of \$3888 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation and reprogramming of funds to support the High Technology Light Division. The funding decrease of \$2889 thousand in FY 1984 results from the net effect of accelerating the advanced development of the VOLCANO helicopter mine-dispensing system to support the High Technology Light Division (HTLD) and program restructuring within the countermines area. Also, funding is provided for the Robotic Obstacle Breaching Assault Tank (ROBAT), a newly articulated countermines system requirement.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Component work and exploratory development for this program are conducted in Program Elements #62733A (Mobility Equipment Technology) and #63806A (Landmine Warfare/Barrier Development). Engineering development efforts which result from this program are accomplished in Program Elements #64612A (Countermines & Barriers) and #64619A (Landmine Warfare). Mine and countermines efforts are closely coordinated to incorporate counter-countermeasures as applicable. Development information on mines is coordinated and exchanged between the Services by the Tri-Service Joint Technical Coordinating Group for Bombs, Mines, and Clusters. The Department of Defense Armaments Munitions Requirements and Development Committee monitors the scatterable mine program to avoid Service duplication.

F. (U) WORK PERFORMED BY: The US Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA, is assigned countermines and barrier development responsibility. Armament Systems Directorate, US Army Armament Research and Development Command (ARRADCOM), Dover, NJ, is assigned responsibility for landmine systems.

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Program Element: #63619A

Title: Landmine/Barrier Systems

DOD Mission Area: #213 — Land Combat Engineer
Support

Budget Activity: #4 — Tactical Programs

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) **D343 — Robotic Obstacle Breaching Assault Tank (ROBAT) (NEW START):** The system will incorporate a tank chassis with a mine roller and/or plow for mine detection, a line charge for breaching, and a cleared lane marking system (CLAMS). The vehicle will be capable of being controlled from a remote position. ROBAT will provide the heavy division with its only capability to breach minefields in stride and under fire. The project is a newly articulated requirement with first RDTE funding requested for FY 1984. Initial work will involve prototype design, fabrication of mounts for the rollers, plow and line charges, and development of a remote control system.

2. (U) **D606 — Countermine and Barrier Systems:** This project provides for advanced development and validation of countermine system concepts, combat shelters, and field fortification techniques. Activities leading to a family of mutually supporting mine detection and neutralization devices are included. Items under development include a portable mine neutralization system (POMINS), a vehicle magnetic signature duplicator (VEMASID), and others. During FY 1982 and FY 1983, advanced development continues on POMINS and VEMASID. Specific activities include prototype testing for POMINS and evaluation of magnetic coil configuration for application to various vehicles on VEMASID. In FY 1984, advanced development efforts will be initiated on the remote airborne minefield detection system (AMIDS), in particular the application of current technology to a remotely piloted vehicle (RPV) system optimized for minefield detection. Requested funding for this project is significantly less than originally projected since countermine technology has not matured rapidly enough to move efforts from Program Element 63606A, Project #D608. The FY 1984 funding request for Program Element 63606A has been increased accordingly.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984:

1. (U) **Project: D005 — Landmine Systems**

a. (U) **Project Description:** Provides for advanced development and validation of landmine system concepts and for defining operational, technical, and logistical concepts for new landmine systems. Current items under consideration include: (1) an off-route antitank mine with effective standoff warhead; (2) improved conventional mines using technology from developed scatterable mines; and (3) a universal mine-dispensing system (VOLCANO). VOLCANO will be developed to provide a rapid mine dispensing capability for helicopters as well as a variety of ground vehicles.

b. (U) **Program Accomplishments and Future Efforts:**

(1) (U) **FY 1982 Accomplishments:** Completed advanced development on the horizontal action off-route antitank mine system (ORATMS). Work was initiated on VOLCANO.

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Program Element: #63619A

Title: Landmine/Barrier Systems

DOD Mission Area: #213 — Land Combat Engineer Support

Budget Activity: #4 — Tactical Programs

(2) (U) FY 1983 Program: Continue accelerated advanced development on VOLCANO. This will include initial system design and prototype fabrication.

(3) (U) FY 1984 Planned Program and Basis for Budget Year Request: Continue advanced development on VOLCANO and initiate advanced development of an improved conventional mine system (ICOMS). The major increases in VOLCANO costs for FY 1984 are for the second build of prototype dispensers, airworthiness qualifications for the UH-60 and UH-1H helicopters, and for user testing. The accelerated schedule includes sufficient testing to permit possible limited fielding of the helicopter system for HTLD at the completion of advanced development.

(4) (U) Program to Completion: This is a continuing program.

c. (U) Major Milestones:

Major Milestones	Current Milestone Dates	Milestone Dates Shown in FY 1983 Submission
VOLCANO:		
Complete Development Test I and Operational Test I (DT I/OT I)	Dec 1984	None
Conduct Validation In-Process Review (IPR)	Mar 1985	None

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63627A

Title: Combat Support Munitions

DOD Mission Area: #215 — Land Warfare Support

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2520	2693	6865	29693	Continuing	Not Applicable
DE82	Smoke Munitions and Materiel	2520	2693	6865	29693	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: New and significantly improved smoke/obscurant systems are required to protect US forces from advanced Soviet surveillance and target acquisition electro-optical devices which operate across the electromagnetic spectrum (from visible to the radar region). The currently fielded US Army smoke systems were largely developed before and during World War II and are not capable of providing the rapid, broadband, long-duration screening required for our armored vehicles, critical installations, assembling forces, and logistical complexes to survive on the modern battlefield. This program element supports the advanced development of new and improved smoke munitions and materiel.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)		2520	2693	6865	Continuing
Funds (as shown in FY 1983 submission)		3149	2700	13700	Continuing

The FY 1982 decrease of \$629 thousand is a result of the decision to redirect the Large Area Screening System program. This decision changed the thrust of the program to emphasize infrared (IR) rather than visual screening; terminated the XM49 Large Area Screening System; and, after reformulation of the development plan, initiated development of the XM52 Large Area Screening System. The original XM49 program included a secondary capability of IR screening, but also required that the system be manportable because of the then-current employment concept. The size and weight restrictions imposed by the manportable requirement made the XM49 less than fully effective in disseminating the heavier IR-screening materiel. A change in the user employment concept to vehicular-mounted systems and increased concern about threat IR capabilities made it both possible and necessary to increase the capacity of the Large Area Screening System. The XM52 is based on the technology developed for the XM49, but provides

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Program Element: #63627A

Title: Combat Support Munitions

DOD Mission Area: #215 — Land Warfare Support

Budget Activity: #4 — Tactical Programs

the increased capability required to effectively disseminate IR-screening materiel. The funding decrease of \$7 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. The FY 1984 decrease of \$6835 thousand is a result of a one-year delay in starting advanced development of the 155mm IR-defeating projectile, the decision to move up the transition of the XM76 IR-defeating grenade from this program element to engineering development, a decision to redirect funds to other higher priority programs, and a revision of the anticipated inflation in the proposed Army RDTE budget. The one-year delay of the 155mm IR-defeating projectile was necessary to allow the completion of additional exploratory development work on the projectile, largely to address the problems involved in disseminating IR-screening materiel from high-velocity projectiles. The earlier transition of the XM76 IR-defeating grenade exploits the excellent performance achieved to date in the program and addresses the increased concern about threat IR weapon sights and guided munitions.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: This program is supported by Program Elements #62622A (Chemical and Smoke Munitions); #64601A (Infantry Support Weapons); and #64609A (Combat Support Systems). In order to meet other Service needs and to prevent unnecessary duplication of effort, liaison personnel from each Service monitor the developing agency's programs.

F. (U) WORK PERFORMED BY: In-house work is conducted by United States (US) Army Armaments Research and Development Command, Dover, NJ. Contractors are Battelle Corporation, Columbus, OH, and AAI Corporation, Cockeysville, MD.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: DE82 — Smoke Munitions and Materiel: New and significantly improved smoke/obscurant systems are required to protect US forces from advanced Soviet surveillance and target acquisition devices which operate across the electromagnetic spectrum (from visible to the radar region). The currently fielded US Army smoke systems were largely developed before and during World War II and are not capable of providing the rapid, broadband, long-duration screening required for our armored vehicles, critical installations, assembling forces, and logistical complexes to survive on the modern battlefield. This project supports the advanced development of new and improved smoke munitions and materiel. Advanced development (AD) of the XM76 Infrared (IR) Defeating Grenade and large Area Screening System was continued in FY 1982. The XM76 is designed to be fired from current armored vehicle smoke grenade launchers and will allow the vehicle to screen itself from IR-guided antitank weapons. The Large Area Screening System will replace/supplement the current M3-series smoke generators. It will provide a more reliable capability to screen critical installations, assembling forces, and logistical complexes and will provide IR as well as visual screening. XM76 concept validation was continued and an expanded engineering design test (EDT) for the XM76 was completed in lieu of a Development Test I (DT I). The Large Area Screening System program was redirected to provide screening in IR as well as visual portions of the spectrum. The XM49 Large Area Screening System development effort was terminated and the AD contract for the XM52 Large Area Screening System was awarded. Technology developed in the XM49 program will be applied to the XM52 Large Area Screening System. AD will be continued on the XM52 Large Area Screening and completed on the XM76 IR Defeating Grenade in FY 1983. Development of the prototype XM52 will be completed and fabrication of

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Program Element: #63627A

Title: Combat Support Munitions

DOD Mission Area: #215 — Land Warfare Support

Budget Activity: #4 — Tactical Programs

nine generators for Development Test/Operational Test I (DT/OT I) will begin. In FY 1984, AD of the XM52 Large Area Screening System will be continued. Fabrication of generators for DT/OT I will be completed and DT/OT I will be conducted. AD on the IR Defeating Vehicle Engine Exhaust Smoke System and IR Defeating Smoke Pot will be initiated in FY 1984. The IR-defeating systems are required to replace/supplement currently fielded visual screening systems which are not fully effective against Soviet IR surveillance and weapon sighting systems. The IR Vehicle Engine Exhaust System is required to complement the XM76 IR grenade by allowing vehicles to establish larger, longer duration IR-defeating smoke screens for self-protection and for screening small units and areas. During FY 1984, the AD contract will be awarded, and design and fabrication of prototype hardware will be initiated. The IR Defeating Smoke Pot is required to complement the XM52 Large Area Screening System and to provide an alternate means of establishing moderate-sized IR-defeating smoke screens. Smoke pots provide a quick-reacting, inexpensive means of maintaining continuity of generator-established smoke screens during maintenance and resupply periods and wind shifts. During FY 1984, technology developed in the XM76 grenade program will be used as a starting point in selecting the screening agent and dissemination means, and prototype smoke pots will be fabricated.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63628A

Title: Field Artillery Ammunition Development

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	22404	23883	16799	4731	Continuing	Not Applicable
D007	Field Artillery Ammunition and Fuzes	5021	4899	9029	4731	Continuing	Not Applicable
D276	SADARM	17383	18984	7770	- 0 -	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the design and development of more effective propelling charges, munitions, and fuzing for field artillery systems to offset the advantages in range and numbers currently enjoyed by Warsaw Pact artillery and armor forces. A principal objective is to develop improved approaches to cannon propelling charge and projectile design in the gun propulsion technology program that will provide significantly increased range capability and enable US artillery to compete with and survive against Warsaw Pact forces. Also included is the Advanced Development Program for the Sense and Destroy Armor Artillery Munition (SADARM). The SADARM will provide a fire-and-forget antiarmor capability in the indirect fire role which significantly increases the lethality of field artillery against an armored threat. The fuze efforts encompassed by the program are focused on increasing the operational effectiveness of present munitions. Wireless data transmission techniques are being developed to automatically set fuzes, thereby improving response and reducing human error. A major objective is the development of a new electronic fuze to meet the requirements of advanced weapons systems. Efforts are continuing to reduce annual training costs by developing low-cost training projectiles for the 60mm and 81mm mortar. The Fire Support Mission Area Analysis has identified insufficient munitions lethality against point armored targets as the number one deficiency in the field artillery fire support area. The Army Science Board has identified several areas in which the US has a clear technological lead over potential opponents. These include sensor, semiconductor, and microprocessing technology, among others. Proper emphasis in and financial support of these leads can result in production of Smart munitions which exploit that technological advantage and provide a high degree of leverage to overcome Warsaw Pact numerical advantages. The 8-inch SADARM system is the most advanced of those smart munitions systems and the first in the category of autonomous self-contained munitions.

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Program Element: #63628A

Title: Field Artillery Ammunition Development

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
FUNDS (current requirements)	22404	23883	16799	Continuing	Not Applicable
FUNDS (as shown in FY 1983 submission)	24647	23951	32623	Continuing	Not Applicable

Reduction of \$2243 thousand in the FY 1982 funding level is a result of reprogramming to higher priority Army requirements. The funding decrease of \$68 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. Reduction of \$15824 thousand in the FY 1984 funding level is a result of restructuring the SADARM program and movement of resources to support expanded Engineering Development of SADARM in PE #64631, Project #D369.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: The development items in this program are directly related to exploratory research being done in Program Element #62603A (Large Caliber & Nuclear Technology). Follow-on engineering development is conducted in Program Element #64631 (SADARM). Developments in this program element are compatible with US Marine Corps requirements and are coordinated to preclude duplication of effort. Prior to FY 1979, work now done under Project D008, in Program Element #63629A (Field Artillery Cannon System), was conducted in this program element. Ammunition development conducted in this PE continues to be closely coordinated with all developments in PE #63629A. Fuze development work was accomplished in Program Element #63613A (Advanced Fuze Design) prior to FY 1981.

F. (U) WORK PERFORMED BY: US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; Watervliet, NY; and Aberdeen, MD; Army Materiel Systems Analysis Activity, Aberdeen, MD; Harry Diamond Laboratories and US Army Electronics Research and Development Command, Adelphi, MD; US Army Armament Readiness Command, Rock Island, IL; and US Army Test and Evaluation Command, Aberdeen Proving Ground, MD. Contractors include General Electric Company, Burlington, VT, and Syracuse, NY; Chamberlain Corporation, Waterloo, IA; Aerojet Electro Systems, Azusa, CA; Honeywell Aerospace and Defense Group, Hopkins, MN; Motorola Inc, Scottsdale, AZ; Ferrulmatic Inc, Patterson, NJ; Longhorn Army Ammunition Plant, Marshall, TX; and Armtec, Coachella, CA.

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Program Element: #63628A

Title: Field Artillery Ammunition Development

DOD Mission Area: #212 — Indirect Fire Support

Budget Activity: #4 — Tactical Programs

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D007 — Field Artillery Ammunition and Fuzes: The purpose of this project is to support advanced development of field artillery ammunition items to include inexpensive indirect fire training projectiles for howitzers and mortars that will generate significant annual training cost savings, a gun propulsion program to improve the cannon, projectile, and propelling charge interface, advanced fuze technology for artillery munitions, and an extended range ICM projectile. In FY 1982, development of cool-propellant, high-loading-density, modular propelling charges was continued. Additionally, evaluation of a combustible cartridge case was performed as well as continuation of development of the 200-second time fuze, XM762. FY 1983 goals include continuing development of the XM762 fuze and the XM884 extended range ICM projectile and initiating development of the XM880, 81mm, 1/10th-range, training projectile and a dummy ICM/submunition training projectile. In FY 1984, the XM762 fuze will progress to engineering development in Program Element #64631, Project #D175. Remaining goals include finalizing modular propelling charge configuration, evaluating advanced designs in high-loading-density charges, propellants, and base bleed combustion (to increase range from 10 to 30 percent), completing development of XM880, 81mm, 1/10th-range training projectile, and developing a refractory, metal-coated liner approach for 155mm systems to improve gun tube wear from 100 to 200 percent.

2. (U) D276 — SADARM: This project supports advanced development of the 8" Sense and Destroy Armor (SADARM) projectile, an autonomous fire-and-forget antiarmor munition. In FY 1982 the Phase II component design effort was completed, and Phase III subsystem and system integration was initiated. Orientation and stabilization devices and warhead self-forging fragments were integrated into the submunition design. In FY 1983 the subsystem design and integration will be completed. Phase IV system design and development will be initiated. Fabrication of all-up XM836 SADARM projectiles will be initiated. In FY 1984 all-up round firings will be conducted, and the SADARM will progress to Engineering Development in PE #64631, Project #D369, in second quarter FY 1984.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63633A

Title: Tank and Fighting Vehicle Ammunition Development

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1803	9028	5875	15161	Continuing	Not Applicable
D161	Tank Ammunition and Fuzes	750	7444	2919	6913	Continuing	Not Applicable
D164	Long-Rod Penetrator	1053	1584	916	- 0 -	- 0 -	3553
D167	120mm Tank Ammo & Fuzes	- 0 -	- 0 -	2040	8248	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of this program is to develop ammunition to counter future direct fire combat enemy threats by improving terminal effectiveness, accuracy, range, and reliability. This program consists of three projects: #D161 (Tank Ammunition and Fuzes); #D167 (120mm Tank Ammunition & Fuze Development); and #D164 (Long-Rod Penetrator). Project #D161 provides for the advanced development of improved kinetic and chemical energy tank ammunition and associated training ammunition to combat future tank threats. Project #D167 provides for advanced development of 120mm tank ammunition and fuzes. Project #D164 provides for the advanced development of a new 25mm service round for the Fighting Vehicle System. The need exists for an improved cartridge that will provide a significant increase in engagement and standoff range capabilities against enemy light armor threat systems. The development of this round will enable the Fighting Vehicle System to engage threat systems at longer ranges and still achieve a greater plate penetration, and therefore, a higher kill capability.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	1803	9028	5875	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	- 0 -	9053	12660	Continuing	Continuing

Differences in funding reflect the fact that internal Army reprogramming was required for the 105mm XM797 training round to reenter advanced development in FY 1982 (\$750 thousand). Also, \$1.053 million established the 25mm long-rod penetrator as an advanced engineering development effort. The FY 1983 decrease of \$25 thousand is a result of pro rata application of general Congressional reductions to the RDTEA appropriation. The FY

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Program Element: #63633A

Title: Tank and Fighting Vehicle Ammunition Development

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

1984 change reflects reprogramming during the budget-building process of \$3.7 million to support total Army higher priority programs. Also, \$3.1 million was an Army-initiated change to complete full-scale engineering development of the 120mm XM830 HEAT round in Program Element #64630, Project #D064. Project #D164 was originally an RDTE Product Improvement Program (PIP) in Program Element #64601 (Infantry Support Weapons). This product-improved 25mm round was established as an effort in Program Element #63633. Subsequent evaluation determined that this was a three-year project. The development project was awarded in September 1982. Reprogrammed funding was from Program Elements #63320 (Corps Support Weapons System) and #64601 (25mm Ammo PIPS).

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: Engineering development of this program continues in Program Elements #64632 (105mm Tank Ammunition) Project #D161, #64630 (120mm Tank Gun Ammo Development) Project #D167, and to #64601 (Infantry Support Munitions) Project #D164.

F. (U) WORK PERFORMED BY: In-house agencies include the US Army Armament Research and Development Command (ARRADCOM), Dover, NJ; US Army Test and Evaluation Command, Aberdeen, MD; and Yuma Proving Ground, Yuma, AZ. Contractors include: Chamberlain Mfg. Corp. Waterloo, IA; Flinchbaugh Products, Inc. Red Lion, PA; Nuclear Metals, Inc. Concord, MA; Dayron Corp. Orlando, FL; Bulova Systems & Instruments Div. Valley Stream, NY; and Physics International, San Francisco, CA. The project is managed by Project Manager, Tank Main Armament Systems, Dover, NJ, to insure no duplication of efforts.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) D161 — Tank Ammunition And Fuzes: The purpose of this project is to develop 105mm High-Explosive Antitank (HEAT) Multipurpose (MP) rounds employing the latest technology in shaped liners and fuzing and to develop a range-limited training round for kinetic energy ammunition. FY 1982 accomplishments for the 105mm XM815 HEAT-MP round included testing aeroballistic designs, impact switch designs, warhead and liner designs. An advanced engineering development systems contract was awarded in September 1982. FY 1983 plans include continued validation through the systems contractor and procurement of long-leadtime components for DT I hardware. FY 1984 plans include completion of DT I and initiation of Full-Scale Engineering Development. Type classification is scheduled for fourth quarter FY 1985. The 105mm XM797 training round development is being held in abeyance pending validation of Required Operational Capability.

2. (U) D164 — Long-Rod Penetrator: This project will produce a fin-stabilized, 25mm long-rod penetrator that will greatly improve the range capability and will enable the fighting vehicle system to achieve greater armor plate penetration. In FY 1982, Advanced Development of two long-rod penetrator designs was initiated. A series of penetration, ballistic, and fire control tests were conducted. In FY 1983 a producibility engineering and

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Program Element: #63633A

Title: Tank and Fighting Vehicle Ammunition Development

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

planning (PEP) phase will be initiated and prototype hardware built. In FY 1984 prototype hardware will be tested, and the long-rod penetrator will move to PE #64601 (Infantry Support Weapons).

3. (U) D167 — 120mm Tank Ammunition And Fuzes: This project will develop an improved HEAT-MP 120mm tank round for use in the M1E1 tank. The round will be based on the 105mm XM815 technology and will provide the increased firepower of the 120mm tank cannon. The 120mm XM859 will be a separately identified effort in FY 1984. This work was previously accomplished in project D161. The application of technology developed on the XM815 (105mm HEAT) will be assessed. Inert ballistic tests will be performed, and the baseline cost estimate will be updated.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63635A

Title: Mobile Protected Gun Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	7955	10326	12561	47921	501800	580563
D166	Mobile Protected Gun System (MPGS)	4000	2427	9357	47921	501800	565505
D170	Light Armored Vehicle (LAV-25)	3955	7899	3204	- 0 -	- 0 -	15058

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element objective is to provide both the US Army and the US Marine Corps with a lightweight, antiarmor, assault-capable, combat weapon system that can be deployed by both strategic and tactical airlift aircraft. This program responds to the Services' limited ability to aerielly deploy heavy main battle tanks quickly and in sufficient numbers. It consists of two projects — MPGS (D166) and LAV-25 (D170). MPGS: The MPGS vehicle will provide light divisions and other selected units with the capability to defeat threat tanks, lightly armored vehicles, and wheeled vehicles. The new system will take full advantage of new technology developments as well as those gained from the joint Defense Advanced Research Projects Agency (DARPA)/Army/Marine Corps Armored Combat Vehicle Technology program and the Infantry Fighting Vehicle and M1 (Abrams) Tank programs. The program seeks to conserve dollars, minimize research and development man-hours, and provide both Services an efficient, cost effective combat fighting vehicle. LAV-25: The LAV-25 Program is a joint Army and Marine Corps effort to procure an essentially off-the-shelf, lightweight, antiarmor, assault-capable weapons system. This program will fulfill the near-term mission needs of the Army until the Army decides to product-improve LAV-25 or field a system that provides tank-killing capability for light forces in the far term. The LAV-25 system will be an eight-wheeled armored vehicle armed with the 25mm BUSHMASTER Chain Gun.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	7955	10326	12561	549721	580563
Funds (as shown in FY 1983 submission)	7955	37354	48156	434049	527514

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Program Element: #63635A

Title: Mobile Protected Gun Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

The difference in funding in FY 1983 and FY 1984 is due primarily to a reduction based on higher priority Army requirements. The difference in the total estimated cost is based on a revised program estimate resulting from the Joint Statement of Operational Requirements and inflation resulting from a two-year program deferral.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands)

	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
Weapons, Tracked Com- bat Vehicles, Army (Pro- curement)						
MPGS (D166):						
Funds	- 0 -	- 0 -	- 0 -	- 0 -	2484300	2484300
Quantities	- 0 -	- 0 -	- 0 -	- 0 -	733	733
LAV-25 (D170):						
Funds	- 0 -	25000	132422	205472	181038	543941
Quantities	- 0 -	36	176	257	211	680

E. (U) RELATED ACTIVITIES: This program element reflects the merger of the Army's Mobile Protected Gun — Far Term and the Marine Corps' Mobile Protected Weapons System into a single, joint program called Mobile Protected Gun System, as well as the Army's Mobile Protected Gun — Near-Term program, which has been joined with the Marine Corps' Light Armored Vehicle (LAV) program and called LAV-25. Specific programs related to the technical area of this program element (PE) are: #63602A, Project #D118 (Armored Combat Vehicle Technology); Project #D188 (High Survivability Test Vehicle); PE #62601A (Tank and Automotive Technology); PE #62608A (Tank Gun Development and Tank Ammunition); PE #63621A (Combat Vehicle Propulsion Systems); and PE #63631A (Combat Vehicle Turret and Chassis). Close relationship is maintained with other Services and Governmental agencies. Research and development information concerning combat, tactical, and special-purpose vehicles is also being exchanged via data exchange agreements with allied countries.

F. (U) WORK PERFORMED BY: MPGS (D166) — Primary in-house efforts are being performed by the US Army Tank-Automotive Command, Warren, MI. Other in-house efforts are being performed by the US Army's Armament Research and Development Command, Dover, NJ; Naval Surface Weapons Center, Dahlgren, VA; Human Engineering Laboratory, Aberdeen Proving Ground, MD; Marine Corps Development and Education Command, Quantico, VA; Ballistics Research Laboratory, Aberdeen Proving Ground, MD; and Test and Evaluation Command, Yuma, AZ. Contracts related to this

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Program Element: #63635A

Title: Mobile Protected Gun Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

effort were competitively awarded during FY 1982 for Concept Design Studies. LAV-25 (D170): In-house efforts are being performed by the above agencies with the addition of the Operational Test and Evaluation Agencies of the Army and Marine Corps. On 27 September 1982, a 5-year multiyear contract for the procurement of 969 LAV-25s was awarded to Canadian Commercial Corporation (General Motors of Canada). They were also awarded a \$21.6 million research and development contract to develop several mission role vehicles for the Army and Marine Corps.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) **D166 — Mobile Protected Gun System:** The purpose of the Mobile Protected Gun System program is to provide the light forces of both Services with a lightweight, strategically deployable, protected, assault-capable antiarmor system. The functional objectives of the developmental system are strategic deployability, tactical mobility, lethality, survivability, and sustainability. Strategic deployability will be achieved by prioritizing design considerations that make the system compatible for deployment in the Air Force C5A and C141B aircraft. Tactical deployability requires Air Force C130 transportability without modification as an essential element of tactical mobility. Mobility and agility on the battlefield will be achieved through design balance of vehicle geometry, mobility subsystems, horsepower-to-weight ratios, and other technology gained from the Armored Combat Vehicle Technology program as well as the Infantry Fighting Vehicle and M1 (Abrams) Tank programs. In FY 1982, concept design studies were received from both Army and Marine Corps requirements. Results from the Armored Combat Vehicle Technology Program, Field Analysis Concept Tests, and Advanced Antiarmor Vehicle Evaluation (ARMVAL) were compiled and evaluated. A trade-off analysis was conducted to harmonize Army and Marine Corps requirements into a single vehicle design. A draft Joint Statement of Operational Requirements was prepared and is being staffed. A joint Program Managers Office was established. Development of a 75mm cannon and ammunition was initiated. In FY 1983 a joint general officer review was conducted, resulting in the deferral of the Demonstration/ Validation phase until FY 1985. Development efforts on the 75mm cannon and ammunition program are continuing. Further refinement of design concepts with respect to new technology will take place. The FY 1984 planned program includes demonstration of selected component capability, selection and preliminary demonstration of lightweight material application and system/force structure analysis with respect to the selection of the most cost effective alternatives. An April 1985 Defense Systems Acquisition Review Council is planned.

2. (U) **D170 — Light Armored Vehicle:** The purpose of the LAV-25 program is to provide the Army and Marine Corps an interim solution until the Mobile Protected Gun System is developed and fielded. In FY 1982 the Army and Marine Corps conducted development and operational tests on four competing prototype vehicles. On 27 September 1982, the General Motors of Canada vehicle was selected as the winner. In addition to a five-year multiyear procurement contract, GM of Canada was awarded a \$21.6 million research and development contract to develop several mission role vehicles on the same chassis for the Army and the Marine Corps. The Army portion of the research and development contract is \$5.0 million for an LAV-25 and a recovery vehicle. In FY 1983 an LAV-25 and recovery vehicle prototype will be procured and tested. The contractor will provide the initial elements of the Integrated Logistics Support package such as manuals, test support package, initial training packages, and the Logistics Support

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Program Element: #63635A

Title: Mobile Protected Gun Program

DOD Mission Area: #211 — Direct Fire Combat

Budget Activity: #4 — Tactical Programs

Analysis. The Army and Marine Corps will jointly fund the procurement of training devices required prior to fielding. The FY 1984 program will complete all testing for the recovery vehicle and complete the Integrated Logistics Support package.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63702A

Title: Electric Power Sources

DOD Mission Area: #215 — Land Warfare Support

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ In Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	3684	2990	10586	9646	Continuing	Not Applicable
DG10	Advanced Tactical Power Sources	984	1890	2000	1925	Continuing	Not Applicable
DG11	Advanced Electrical Energy Sources	2700	1100	8586	7721	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: New and developing sophisticated command and control, intelligence, fire control communications, and weapons systems depend heavily on the availability of electric power sources tailored to their requirements. Existing mobile generators are excessively noisy and emit heat signatures that significantly increase the vulnerability of supported battlefield systems to detection by enemy surveillance. In addition, current-generation generators are not designed with the reliability necessary for extended operation required to provide continuous power for critical battle systems. The uncertain world petroleum supply situation and the high cost of petroleum-derived fuels also drive the development of newer electric power concepts that are capable of higher fuel efficiency and of using alternate fuels. Current engine-driven generators, particularly in the 0.5-10kW sizes do not meet the Army's forward battlefield area electric power needs. This program provides the necessary technologies required for improved mobile electric power systems with emphasis on reduced noise and heat signatures, greater mobility, higher efficiency, improved reliability and multifuel and/or nonfossil fuel capabilities. This program also funds the development of higher energy density, longer life batteries, and improved low-power sources to satisfy the unique tactical and logistical requirements of portable battlefield electronics systems.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ In Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	3684	2990	10586	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	5072	2998	5197	Continuing	Not Applicable

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Program Element: #63702A

Title: Electric Power Sources

DOD Mission Area: #215 — Land Warfare Support

Budget Activity: #4 — Tactical Programs

In FY 1982 the \$1388 thousand decrease in funding was the result of reprogramming to then higher priority Army programs. The decrease of \$8 thousand in the FY 1983 funding level is a result of pro rata application of general Congressional reductions to the RDTEA appropriation. The \$5383 thousand increase in FY 1984 funding is the result of program realignment to ensure the expeditious correction of the serious deficiency in tactical electric power by accelerating the ongoing development work and expanding the number of technologies being considered.

D. (U) OTHER APPROPRIATION FUNDS: (\$ In Thousands) Not Applicable.

E. (U) RELATED ACTIVITIES: In order to preclude a duplication of effort, the Army maintains continuing coordination with the other Services, the Department of Energy, the National Aeronautics and Space Administration, the Department of Health and Human Services, and the Department of Transportation through the Interagency Advanced Power Group and the Department of Defense Project Manager for Mobile Electric Power. The Power Sources Conference sponsored by the US Army Electronics Research and Development Command provides a forum for exchange of information between Government, academic, and industrial researchers. Additionally, the Joint Deputies for Laboratories (Panel for Batteries and Fuel Cells) assures coordination between the Services on programs concerning battery and fuel cell systems. Advanced Development Items in this program element progress to Engineering Development in Program Element #64714A (Tactical Electric Power Sources). Related basic research is conducted in Program Element #61102A (Defense Research Sciences), Project #AH47 (Electronic Device Research), and Project #AH51 (Combat Support). Exploratory Development is conducted in Program Element #62733A (Mobility Equipment Technology).

F. (U) WORK PERFORMED BY: In-house work is performed by the US Army Mobility Equipment Research and Development Command, Fort Belvoir, VA, and the US Army Electronics Research and Development Command, Fort Monmouth, NJ. The three development contracts in effect are with the following firms: Energy Research, Danbury, CT; MTI, Latham, NY; Stirling Power Systems, Ann Arbor, MI.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984:

1. (U) **DG10 — Advanced Tactical Power Sources:** This project includes the development of new high-energy-density, long-operating life/long-storage life batteries needed to satisfy the unique tactical and logistical requirements of portable battlefield electronic systems. It also includes the development of low power sources for various tactical electronic systems. In FY 1982, development of high-energy-density, second-generation lithium batteries continued with the evaluation of the prototype cells in the high-stress environments of artillery-delivered sensors and jammers. In FY 1983, high-energy-density, high-power lithium cells are being configured into batteries for laser target designator applications and will undergo engineering evaluation. In FY 1984, testing of the lithium batteries for laser designation and night vision equipment is expected to be completed, and user evaluation of these batteries will be accomplished. In addition, development will be initiated on a low-power DC-to-AC inverter for use in various tactical command and control systems.

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Program Element: #63702A

Title: Electric Power Sources

DOD Mission Area: #215 — Land Warfare Support

Budget Activity: #4 — Tactical Programs

2. (U) DG11 — Advanced Electrical Energy Sources: This project includes the advanced development of improved mobile tactical electric power generators, components, power conditioners, and controls. Power conditioners convert a wide variety of input voltages and frequencies to the desired type of power needed. They allow the use of power from foreign (50 Hertz) equipment for our tactical systems and provide essential flexibility for providing electric power in diverse tactical situations. This project is needed to develop silent, reliable technologies with significantly reduced infrared (IR) signatures to replace the low-reliability, noisy, easily detectable generation of generators that are currently in use and to provide power supply alternatives demanded by modern battlefield electronic systems. In FY 1982, fabrication and testing of a prototype (brassboard) model of the 3kW Methanol Fuel Cell (MFC) was completed. Development was initiated on the 3kW Free Piston Stirling Engine Powered Silent Generator Set (FPSE). Developing both the MFC and the FPSE technologies is essential for ensuring the successful full-scale development in the minimum time of 3kW-10kW silent, lightweight electric energy plants that have minimum IR detectability and that can use alternate fuels. Alternate technologies also provide the basis for better tailoring of electric power supply options to the operational requirements of various battlefield electronic systems. In FY 1983, development of the 3kW MFC and the 3kW FPSE continue, and the initial design of the 10/15kW power conditioner will be accomplished and hardware development initiated. Design of the 3kW and 30kW power conditioners will be initiated. The significant increase in funding requirements for FY 1984 as compared to FY 1983 is necessary to significantly accelerate the ongoing silent power unit advanced development to meet the urgent field need for silent, low IR signature electric power supplies in the 3kW to 10kW power range. As a result, the 3kW Methanol Fuel Cell is scheduled to complete DT I and Operational Test (OT I) and complete advanced development in FY 1984. Preprototype design of the 5kW MFC will be accomplished and prototypes developed for follow-on testing. Advanced development of the preprototype 3kW FPSE units will be completed and undergo technical evaluation. Fabrication of advanced development 3kW FPSE prototypes will commence in FY 1984 for follow-on testing. In addition, prototypes of the 10/15kW power conditioner will be completed and undergo technical evaluation.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable

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FY 1984 RDTE CONGRESSIONAL DESCRIPTIVE SUMMARY

Program Element: #63705A

Title: Physical Security

DOD Mission Area: #215 — Land Warfare Support

Budget Activity: #4 — Tactical Programs

A. (U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1982 Actual	FY 1983 Estimate	FY 1984 Estimate	FY 1985 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	3043	5437	4740	6769	Continuing	Not Applicable
DK82	Physical Security	3043	5437	4740	6769	Continuing	Not Applicable

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program element is to conduct advanced development of physical security equipment used to provide protection for critical areas, sensitive installations, mobile resources, the rear area of deployed forces, and items in transit against the threat from a dedicated terrorist force. The need is to use physical security equipment to enhance all DOD security to the maximum extent possible and decrease manpower (guard) requirements to a minimum.

C. (U) COMPARISON WITH FY 1983 DESCRIPTIVE SUMMARY: (\$ in Thousands)

	FY 1982	FY 1983	FY 1984	Additional to Completion	Total Estimated Cost
RDTE					
Funds (current requirements)	3043	5437	4740	Continuing	Not Applicable
Funds (as shown in FY 1983 submission)	3813	5452	6897	Continuing	Not Applicable

In FY 1982, \$770 thousand was withdrawn for a higher priority project. The funding decrease of \$15 thousand in FY 1983 is a result of pro rata application of general Congressional reductions to the RDTE, A appropriation. The reduction in FY 1984 funding is a result of reallocation to higher priority programs.

D. (U) OTHER APPROPRIATION FUNDS: (\$ in Thousands) Not Applicable.

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Program Element: #63706A

Title: Physical Security

DOD Mission Area: #215 — Land Warfare Support

Budget Activity: #4 — Tactical Programs

E. (U) RELATED ACTIVITIES: The exploratory development for physical security equipment is conducted under PE #62733A, Project AH20 (Mobility Equipment Technology), and Defense Nuclear Agency Task B99QAXRF/Technology Development. The improved processing technique effort and the fiber optic data link, which entered advanced development in FY 1980, are outgrowths of these projects. This program supports the engineering development Program Element #64718A (Physical Security) in which the major item is the Interim Facility Intrusion Detection System (FIDS). Related are the Army's Remotely Monitored Battlefield Sensor System (REMBASS) tactical sensor program, the Weapons Access Delay System (WADS), and the Air Force's Base and Installation Security System (BISS) exterior physical security program. Close coordination with REMBASS, WADS, BISS, and the Navy is being accomplished to assure utilization of related technologies and developments and to prevent duplication of effort. Coordination is accomplished by joint working groups and attendance at other Service and department meetings. The DOD Physical Security Equipment Action Group monitors and coordinates the development and acquisition of physical security equipment by all Services. The Department of the Army's single point of contact is the Product Manager for Physical Security Equipment (PMPSE), who monitors and coordinates the development, acquisition, integrated logistic support, and installation of physical security systems.

F. (U) WORK PERFORMED BY: The United States (US) Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA, is assigned responsibility for Physical Security Research, Development, Test and Evaluation (RDTE). Another Government agency currently involved is the US Army Test and Evaluation Command, Aberdeen Proving Ground, MD. Major contractors are E-Systems, Melpar Div., Arlington, VA; Southwest Research, San Antonio, TX; Tetra Tech, Incorporated, Pasadena, CA; ENSCO Incorporated, Springfield, VA; and Scope Inc, Reston, VA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984: DK82 — Physical Security: Developments will be directed towards satisfying the Army, Air Force, and Navy materiel need for an interior security system (Facility Intrusion Detection System (FIDS)) and their requirement for a Physical Security Lighting and Barrier System, Rear Area Physical Security (RAPS) Systems, Weapons Area Denial System, Transit Security, and Locks, Safes, and Containers. Development will include the following: (1) sensors, including penetration, motion, item removal, and contraband; (2) electronic and fiber optic data links, data link security supervisory components, and centralized data processing components; (3) alarm display, monitoring, and readout components; (4) physiological and/or psychological deterrent devices; (5) devices to protect cargo in depots or in transit by truck or ship; (6) devices to provide physical security for the rear area of deployed forces; (7) standardized security equipment and locking hardware; (8) exterior lighting and barrier systems; and (9) weapons area denial. Interfaces necessary to integrate exterior sensors developed by the Air Force and potential ship-board security equipment components adopted by the Navy will also be developed in consonance with the direction from the Under Secretary of Defense (Research and Engineering) (memo of 26 July 1979). In addition, there will be a continuing evaluation of commercial physical security equipment as well as those items that might be developed by other Government agencies. During FY 1982, advanced development (AD) was initiated or continued on Advanced FIDS sensors, communication links, deterrents, and data acquisition and analysis equipment. The Advanced FIDS Covert Duress Sensor and Tagged Material Detector progressed to full-scale development (FSD). During FY 1982 Prototype Electronic Alerting Systems were assembled, and a site survey to select European test sites was completed. Plans for FY 1983 include the following FIDS actions: Continued AD of

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Program Element: #63708A

Title: Physical Security

DOD Mission Area: #215 — Land Warfare Support

Budget Activity: #4 — Tactical Programs

improved Advanced FIDS sensors and data links; conducting advanced development testing (ADVT) of an Internal Fiber Optic Data Link, a Deterrent System, and an External Radio Frequency Data Link; and transition of the RF Motion Sensor into FSD. The prototype Electronic Alerting Systems will undergo operational testing in Europe in FY 1983. A new AD effort will be initiated to develop Rear Area Physical Security (RAPS) for the Ground-Launched Cruise Missile System (GLCMS) and to provide security and protection in the rear area where mobile/transportable combat support equipment and functions are located. AD will be initiated on the command and control subsystem for a weapons area denial system, a high-priority item in view of increasing dedicated terrorist activity in Europe, to enhance security of nuclear weapons in NATO. AD will be completed during FY 1984, and the denial system will enter FSD in FY 1985. During FY 1984, AD will continue on Advanced FIDS components. ADVT will be initiated for the Advanced FIDS External Fiber Optic Data Link and for the Internal and External Fiber Optic Surveillance Link. The RF Data Link, Internal Fiber Optic Link, and Deterrent System will enter FSD. A special-purpose in-process review will be conducted for the Electronic Alerting System in FY 1984. AD will continue during FY 1984 on semipermanent and transportable/mobile Rear Area Physical Security Equipment to meet Air Force requirements.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1984: Not Applicable.

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The proponent agency of this pamphlet is the Office of the Deputy Chief of Staff for Research, Development and Acquisition. Users are invited to send comments and suggested improvements to HQDA (DAMA-PPR-B), Washington, DC 20310.

By Order of the Secretary of the Army:

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